D. Hume


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Memorandum of Association

OF

THE SANITARY INSTITUTE.

1. The name of the Association is "THE SANITARY INSTITUTE."
2. The Registered Office of the Association will be situate in England.
3. The objects for which the Association hereinafter referred to as the "Institute" is established are :—
   - (*a*) To take to and over the whole of the assets and liabilities of the Association which received the support of Her Most Gracious Majesty the Queen, was presided over by His late Royal Highness the Duke of Albany, and on the 28th day of June, 1882, was incorporated under the name of "The Parkes Museum," pursuant to license from the Board of Trade, granted under the provisions of the Act 30 & 31 Vict. c. 131, and also to take to and over the whole of the assets and liabilities of the Unincorporated Society or Association established in the month of July, 1876, under the style or title of "The Sanitary Institute of Great Britain" and to enter into such Agreements, and to make, do and execute all such acts, deeds, matters and things, as may be necessary for the purpose of taking to and over such assets and liabilities or any part thereof.
   - (*b*) To assist or concur, if and so far as the Institute may be advised that its assistance or concurrence is required, in the winding up and ultimate dissolution of the said Parkes Museum and Sanitary Institute of Great Britain respectively.
   - (*c*) To promote the advancement of Sanitary Science in all or any of its branches, and the diffusion of knowledge relating thereto, either in all or any of the ways hereinafter specified or in any other way.
     - (i) The holding of Examinations and granting of Certificates of competency in Sanitary knowledge to any persons wishing to obtain such Certificates, and the prescribing of the mode and time of holding such Examinations. Provided that no Certificate or Diploma shall be granted by the Institute as a qualification to discharge the duties of a Medical Officer of Health or other Medical Office, and that every Certificate granted shall bear on the face of it a

statement that such Certificate is not a qualification registrable under the medical Act, 1886.

(ii) The constitution of two classes of Members, namely, Ordinary Members and Fellows; and (in addition to the persons who on the incorporation of the Institute are then or will be entitled to become Fellows, and to any persons including Trustees and legal personal representatives who shall be elected or become Fellows according to the Regulations of the Institute for the time being, in respect of any donation or bequest for general or special purposes, or upon any trust) the election from time to time from among the Ordinary Members to the degree or status and title of Fellows, of such of them as shall, in the opinion of the Council of the Institute, be eligible thereto upon one or other of the following grounds, viz.: (1) That he is an eminent man of science; (2) That he is a person of distinction as a legislator or an administrator; (3) That he is a person who has done noteworthy sanitary work: also the election, if and when thought proper, of Foreigners distinguished in connection with Sanitary Science as Honorary Fellows: also the constitution, if and when thought proper, of a class of persons as Associates of this Institute: and the determination of the regulations, liabilities, and conditions which are to affect Fellows, Ordinary Members, Honorary Fellows, and Associates respectively. Provided that no Honorary Fellow and no Associate shall as such be a Member of the Institute, or have any share in the Government thereof, or have any other rights or privileges except such as may from time to time be conferred by the Institute or its Regulations.

(iii) The maintenance in London, or elsewhere in the United Kingdom, of a Museum of Hygiene, to be called "The Parkes Museum," to aid in the scientific investigation and practical study of all matters relating to health and the laws thereof, and, subject to subsection (*e*), as a permanent Memorial of the late Edmund Alexander Parkes, M.D., F.R.C.P., F.R.S.

(iv) The establishment, if necessary, and the maintenance in London or elsewhere in the United Kingdom, of Libraries, Laboratories, and Lecture Rooms: the institution of courses of lectures and demonstrations: the holding of meetings for the hearing of communications on sanitary subjects, and discussions thereon: the holding of Congresses for the consideration and discussion of subjects relating to Hygiene: the holding of Exhibitions of sanitary objects, apparatus, and

appliances: the work of practically testing any such sanitary objects, apparatus, or appliances as at any such exhibition or otherwise may be brought before the notice of the Institute: the awarding of medals or certificates of merit for any such objects, apparatus, or appliances in cases which the Institute deem worthy of such recognition: and the issuing, editing, and publication of books, pamphlets, or other literary matter relating to or connected with Sanitary Science.

(v) The acceptance of any gift, endowment, or bequest made to the Institute generally, or for the purpose of any specific object connected with Sanitary Science; and the carrying out of any trusts attached to any such gift, endowment, or bequest. Provided that if any gift, endowment, or bequest made not for the general purposes of the Institute, but for a specific object, shall be in the nature of a charitable endowment so as to be subject to the jurisdiction of the Charity Commissioners, the Institute shall observe all rules and directions of the Charity Commissioners with respect thereto, and if so required vest the same in special Trustees thereof.

(vi) The amalgamation with the Institute under its present name, or under any other name duly assumed according to law, and the prosecution of the objects of any association or institution having objects similar to those, or any of those of the Institute, and registered with the licence of the Board of Trade under Section 23 of the Companies' Act, 1867, including the promotion of good cookery, the abatement of smoke, and other things of hygienic importance, though not pursued with exclusive reference to health.

(*d*) Subject to the provisions of Section 21 of the Act 25 and 26 Vict. c. 89, to purchase, rent, or otherwise acquire and hold, for the purposes of the Institute, land, houses, or buildings, and to erect, alter, or adapt houses or buildings accordingly.

(*e*) To sell, dispose of, exchange, or part with any of the property of the Institute as may from time to time be considered expedient or desirable in the interests of the Institute.

(*f*) If and when considered advisable to obtain a Royal Charter or Act of Parliament for the purposes of the Institute, and continuing the work thereof.

(*g*) Upon any such Charter or Act of Parliament being obtained, or otherwise if considered desirable, to wind up and dissolve the Institute.

(*h*) To do all such other lawful things as may from time to time be incidental to or conducive to the attainment of

the above objects, or any of them, including the promotion of good cookery, the abatement of smoke, and other things of hygienic importance, and supporting institutions for promoting any of such things, whether or not pursued with exclusive reference to health.

4. The income and property of the Institute, whencesoever derived, shall be applied solely towards the promotion of the objects of the Institute as set forth in this Memorandum of Association, and no portion thereof shall be paid or transferred, directly or indirectly, by way of dividend, bonus, or otherwise howsoever by way of profit to the Members of the Institute. Provided always that nothing herein shall prevent the payment, in good faith, of remuneration to any Officer or Servant of the Institute, or to any member thereof, or to any other person in return for services actually rendered, or to be rendered to the Institute.

5. The 4th paragraph of this Memorandum is a Condition on which a License is granted by the Board of Trade to the Institute in pursuance of Section 23 of the Act 30 and 31 Vict. c. 131.

6. If any Member of the Institute shall pay or receive any dividend, bonus, or other profit in contravention of the 4th paragraph of this Memorandum, his liability shall be unlimited.

7. Every Member of the Institute, undertakes to contribute to the assets thereof in the event of the same being wound up during the time he is a Member, or within one year afterwards, for payment of the debts and liabilities of the Institute contracted before the time at which he ceases to be a member, and for the costs, charges, and expenses of winding up the same, and of the adjustment of the rights of the contributories among themselves such amount as may be required not exceeding £1, or in case of his liability becoming unlimited such other amount as may be required in pursuance of the last preceding paragraph of this Memorandum.

8. If upon the winding-up or dissolution of the Institute there remain, after the satisfaction of all its debts and liabilities, any property whatsoever, the same shall not be paid to, or distributed among, the Members of the Institute, but shall be given or transferred to some other Institution or Institutions having objects similar to the objects of the Institute, to be determined by the Members of the Institute, at or before the time of its dissolution, or in default thereof, by such Judge of the High Court of Justice as may have, or acquire jurisdiction in the matter.

9. True accounts shall be kept of the sums of money received and expended by the Institute and the matter in respect of which such receipt and expenditure takes place, and of the property, credits, and liabilities of the Institute; and subject to any reasonable restrictions as to the time and manner of inspecting the same that may be imposed in accordance with the Regulations or By Laws of the Institute for the time being shall be open to the inspection of the Members. Once at least in every year the accounts of the Institute shall be examined and the correctness of the balance-sheet ascertained by one or more properly qualified auditor or auditors.

We, the several persons whose names and addresses are subscribed, are desirous of being formed into a Company, in pursuance of this Memorandum of Association.

Names, Addresses, and Description of Subscribers.

Northumberland. 2, Grosvenor Place; Peer of the Realm.

Westminster. Grosvenor House; Peer of the Realm.

Douglas Galton, K.C.B., late Royal Engineers. 12, Chester Street, Grosvenor Place, S.W.

George James Symons, F.R.S., Meteorologist. 62, Camden Square, N.W.

Thomas Hayter Lewis, F.S.A. 12, Kensington Gardens Square.

Mark Hayler Judge, A.R.I.B.A. 8, Park Place Villas, W.

William Henry Corfield, M.A., M.D. (Oxon.) 19, Savile Row, W.

Thomas Twining, Gentleman. Perryn House, Twickenham.

Edwin Chadwick, C.B. East Sheen, Mortlake, Surrey.

Rogers Field, B.A., M.Inst.C.E. 4, Westminster Chambers, S.W.

T. Orme Dudfield. 14, Ashburn Place, S.W. (Doctor in Medicine).

Charles H. Parkes, Gentleman. Netherfield, Weybridge.

Charles E. Cassal, F.I.C., F.C.S., Public Analyst. Town Hall, Kensington.

G. V. Poore, M.D., F.R.C.P., Physician. 30, Wimpole Street, W.

Dated the 16th day of August, 1888.

Witness to the above Signatures,

E. White Wallis,

Secretary of the Sanitary Institute of Great Britain, and of the Parkes Museum, 74a, Margaret Street, W.

Articles of Association

OF

THE SANITARY INSTITUTE.

I.—Preliminary.

1. In the construction of these Articles, unless repugnant to the subject-matter or the context, the singular shall include the plural, and the masculine the feminine, and vice versâ, the word person shall include a Corporation, and the following words and expressions shall have the meanings hereinafter assigned to them :—

WORDS INTERPRETED.	MEANINGS ATTRIBUTED THERETO.
The "Institute."	The Association incorporated as a Company, limited by guarantee, and with the title of "The Sanitary Institute," under the Memorandum of Association which is accompanied by these Articles.
"Member."	A person who has become and is a Member of the Institute according to the Regulations. Members include both Fellows and Ordinary Members.
"Fellow."	A person who being, or on his becoming, a Member, shall according to the Regulations be or become a Fellow of the Institute, so long as he shall continue a Fellow according to the Regulations.
"Ordinary Member."	A person who shall become an Ordinary Member of the Institute, and so long as he shall continue an Ordinary Member according to the Regulations.
"Associate."	A person not a Member of the Institute who shall become an Associate thereof under the Regulations, and so long as he shall continue to be an Associate.
The "Regulations."	The Memorandum of Association and these Articles of Association.

WORDS INTERPRETED.	MEANINGS ATTRIBUTED THERETO.
	and other the Articles of Association of the Institute from time to time in force.
"Special Resolution."	A special Resolution of the Institute passed in accordance with Section 51 of the Act 25 and 26 Vict. *c.* 89.
"Extraordinary Resolution."	A Resolution of the Institute passed in such manner as would, if confirmed by a subsequent Meeting, have constituted a special Resolution.
"Council."	Members acting as the Directors or Managers of the Institute under the Regulations, or, as the case may be, the Members of the Council assembled at a Council Meeting.
"Member of Council."	A Member of the Institute who is one of the Council of the Institute under the Regulations.
"Secretary."	The Secretary of the Institute.
"General Meetings."	General Meetings (whether Ordinary or Extraordinary) of the Members duly called and constituted, and any adjourned holding thereof.
"Seal."	The Common Seal from time to time of the Institute.
"Month."	A Calendar Month.

II.—Ordinary Members and Fellows.

2. For the purposes of registration the number of Members of the Institute is declared to be One Thousand.

3. The Signataries to these Articles of Association shall, on the registration of these Regulations with the Memorandum of Association, become and be Fellows of the Institute.

4. Each and every of the following persons, namely, (*a*) the original Trustees of the Parkes Memorial Fund, appointed at a Meeting of the Subscribers thereto, held at University College, London, on or about the 28th day of May, 1878, (*b*) the Signataries of the Articles of Association of the Parkes Museum aforesaid, (*c*) the persons who shall, on the incorporation of the Institute, be either President, Vice-Presidents, or Honorary Officers or Members of the Council, or Honorary Members of the Parkes Museum aforesaid, (*d*) or the persons who shall, on the incorporation of the Institute, be either President or Vice-Presidents, or Honorary Officers or Members of the Council or Fellows of the Sanitary Institute of Great Britain aforesaid, shall respectively, on signing before the 31st December, 1888 (unless in particular cases a longer time for

such signature be allowed by the Council), an application in the prescribed form to become a Member of the Institute, immediately on his being registered as a Member, become and be entitled to bear the title of Fellow of the Institute. Every person not within the category aforesaid who, on the registration of the Institute, shall be (*e*) an Ordinary Life Member of the Parkes Museum, or (*f*) a Life Member of the Sanitary Institute of Great Britain, or who, at any time during the twelve months preceding such registration, shall be or have been (*g*) an Ordinary Annual Member of the Parkes Museum, or (*h*) an Annual Member of the Sanitary Institute of Great Britain, shall be entitled, upon signing before the 31st December, 1888 (unless in particular cases a longer time for such signature be allowed by the Council), an application or request in the prescribed form, to be forthwith registered as an Ordinary Member, and shall thereupon become an Ordinary Member of the Institute.

5. Every person becoming a Member of the Institute, under Clause 3 or Clause 4, who shall have been an Ordinary Life Member or Honorary Member of the Parkes Museum, or a Fellow or Life Member of the Sanitary Institute of Great Britain, shall be exempt from any liability or obligation to pay any entrance fee or annual subscription to the Institute.

6. Any Donor to the Institute of not less than £1,000 at one time, or of several sums at different times, none of which shall be less than £250, and which shall in the aggregate amount to £1,000 at the least, whether the money shall be his own money, or shall be given or paid in pursuance of any discretionary or imperative trust, or any one or more of any body of trustees, or legal personal representatives being such donors, or any one or more of the legal personal representatives for the time being of any testator bequeathing, or having bequeathed, not less than £1000 to the Institute, shall be eligible as a Fellow of the Institute: if elected shall be exempt from any liability or obligation to pay any entrance fee or annual subscription to the Institute. Provided that donations or bequests of stocks, funds, securities or other property to the Institute shall confer the same privileges under this Article as donations, or bequests of the value thereof in money. Provided also that a donation or bequest to the Institute within the meaning of this Article, may be a donation or bequest for the general purposes of the Institute, or in furtherance of any particular object or objects of the Institute, or, provided the donation or bequest be legally valid, upon any trust which the Institute shall accept, and may be subject to any trust, or direction for the preservation thereof in perpetuity, and the application of the income thereof only to the general, or any particular objects or object of the Institute, or upon any such trust as aforesaid.

7. Any person not entitled to become a Member under Clause 4 who shall hereafter be desirous of becoming an Ordinary Member, shall sign a Letter of Application in the prescribed form, which must be also signed in the prescribed form by not less than three Members, and transmit or deliver such Letter of Application so signed as afore-

said to the Secretary, and thereupon such person shall be deemed to have agreed to become, and, upon his being elected as an Ordinary Member by the Council, shall thereupon become a Member of the Institute.

8. Any Ordinary Member not entitled to become a Fellow under Clause 4 shall, at the expiration of one year from the commencement of his Membership, but not before, be, if otherwise eligible according to the Regulations, eligible as a Fellow of the Institute: and if elected by the Council as a Fellow, such Member shall thereupon become a Fellow of the Institute.

9. The Election of Fellows shall rest with the Council.

III.—Fees, Subscriptions or Contributions of Ordinary Members and Fellows.

10. The first Members of the Institute whose names are contained in the Schedule hereto, and any person who shall become a Member under Clause 4, shall not be liable to the payment of any entrance fee. And every such Scheduled or other Member (not being exempted from all payments by Clause 5) who shall have been an annual subscriber to the said Parkes Museum, or to the said Sanitary Institute of Great Britain, shall be liable to pay as an annual subscription or contribution to the funds of the Institute only such sum as shall have been the annual amount of his subscription to the said Parkes Museum or to the said Sanitary Institute of Great Britain as the case may be, and in case of subscribers to both the annual amount of his subscription to such one of them as he shall choose: Provided always that every person (not exempted as aforesaid) being a Scheduled Member under Clause 3, or who shall become a Member under Clause 4), shall be entitled at any time within twelve months from the registration of the Incorporation of the Institute, or (as the case may be) at any time within twelve months after he shall so become a Member, to compound for all annual subscriptions to the funds of the Institute then or at any time thereafter payable by a payment to the Institute in one sum within the said period of twelve months of the sum of £10 10s.

11. Subject as aforesaid, and until otherwise determined by the Council, the fees and annual subscriptions or contributions payable by the Members to the Institute and the terms of compounding for the same shall be as follows:—

(*a*) Any person who on his being elected as an Ordinary Member under Clause 7, or on his becoming a Fellow or Ordinary Member under Clause 3 or Clause 4 (not being a person within the exemption of Clauses 5 and 6), shall either be a Medical Officer of Health or have from some Examining Body a Sanitary Science Certificate (the sufficiency of which Certificate shall be recognized by the Council), or be both a Surveyor having his appointment from some Parliamentary Sanitary Authority and a Member or Associate Member of the Institution of Civil Engineers,

or hold the Certificate of the Sanitary Institute of Great Britain or of the Institute, of competency for the appointment of a Local Surveyor, shall, on his election as, or on his becoming a Member as aforesaid, forthwith become liable to and pay by way of subscription or contribution to the funds of the Institute for the year in which he is so elected or becomes a Member the sum of £1 1s., and for each succeeding year during his Membership shall pay on the 1st of January of such succeeding year by way of annual subscription or Contribution as aforesaid the like sum of £1 1s., and shall be exempt from the payment of any entrance fee.

(*b*) Every other person whose case is not hereinbefore otherwise provided for shall, on his being elected as, or becoming a Member, forthwith become liable to, and pay as an entrance fee, payable by him to the funds of the Institute, the sum of £3 3s., and shall, in addition thereto, pay by way of subscription or contribution to the funds of the Institute for the year in which he shall become a Member the sum of £2 2s., and for each succeeding year of his Membership shall pay on the 1st of January of such year, by way of annual subscription or contribution to the funds of the Institute the sum of £2 2s.

(*c*) Provided always that the first annual subscription paid by any persons elected as Ordinary Members between the 25th September in any year and the 1st January in the following year shall cover the year commencing on the said 1st January following.

(*d*) Every Ordinary Member not being entitled to exemption under Clause 6 who shall hereafter be elected a Fellow of the Institute, shall, on his election, forthwith become liable to and pay to the funds of the Institute, as a Fellow's election fee, the sum of £5 5s., but he shall continue to pay the same annual subscription as theretofore.

(*e*) Subject to the special provisions hereinbefore contained, every Member shall be entitled at any time during his Membership to compound for annual subscriptions then or thereafter at any time payable by him (including the subscription payable for the year in which he so compounds), by a payment to the funds of the Institute in one sum of £21, and on such payment all further liability for contribution to the funds of the Institute, except for entrance fee, or Fellow's election fee, shall cease.

12. Provided always that any increase of fees, subscriptions, or composition-money made by the Council over and above what shall have been payable at the time of becoming a Member shall not affect any person who has become a Member previous to the making of such increase.

IV.—Distinguishing Titles of Ordinary Members and Fellows.

13. Any Member desiring to designate himself as belonging to the Institute as a Member thereof shall, as to Fellows, be entitled to so designate himself by the description, Fellow San. Inst.; and in the case of an Ordinary Member be entitled to so designate himself by the description, Mem. San. Inst.

V.—Honorary Fellows.

14. The Council shall have power to elect from time to time, and for such period not exceeding three years, as they shall think fit, as Honorary Fellows of the Institute, such foreigners whose names have been distinguished in connection with Sanitary Science, as the Council shall approve, provided that no person shall by election to the distinction of Honorary Fellow become a Member of the Institute.

VI.—Associates.

15. There may be Associates of the Institute and the persons coming within, or complying with the following regulations relating to Associates, may become such; provided that no person shall by becoming an Associate become a Member of the Institute.

16. Any person who on the registration of the Institute shall be a Life Associate of, or a Life Subscriber to the said Sanitary Institute of Great Britain, or who at any time during the twelve months preceding such registration, shall be, or shall have been an Associate (other than a Life Associate) thereof, or an annual subscriber thereto, shall be entitled upon signing before the 31st December, 1888 (unless in particular cases a longer time for such signature shall be allowed by the Council), an application or request in the prescribed form to become an Associate of the Institute, and every person becoming an Associate under the provisions of this Clause 16, who shall have been a Life Associate of, or Life Subscriber to, the said Sanitary Institute of Great Britain, shall be exempt from any liability to make any payment whatever to the Institute by reason of his Associateship.

17. The Council shall have power to elect from time to time as an Associate any person not entitled to become an Associate under the provisions of Clause 16, who shall have applied in the prescribed form to be elected an Associate.

18. Subject to the exemption in Clause 16, and until otherwise determined by the Council, the fees and annual subscriptions and contributions payable by the Associates to the Institute, and the terms of compounding for the same shall be as follows :—

(a) Every person who shall become an Associate under Clause 16, and who shall not be among those exempted by such Clause, from any liability to make any payment to the Institute, and every person who shall be elected an Associate, and who shall also at the time of his election either have received the Certificate of the Sanitary Institute of Great Britain or of the Institute, of competency for the appointment of Inspector of Nuisances, or have held the appointment of Inspector of Nuisances

in any district at the date of the incorporation of the Institute shall be entitled to become or be elected Associate without entrance fee, but shall on his becoming or being elected Associate pay by way of subscription for the year of his election the sum of 10s. 6d., and thenceforth on the 1st day of January of every year succeeding his election, by way of annual subscription for such year the like sum of 10s. 6d., and shall be exempt from the payment of any entrance fee.

(*b*) Every other person elected an Associate shall, upon his election, pay, by way of entrance fee, the sum of £2 2s. 0d., and by way of subscription for the year of his election, the sum of £1 1s. 0d., and thenceforth on the 1st day of January of every year succeeding his election, by way of annual subscription for such year, the sum of £1 1s. 0d., provided always that the first annual subscription paid by any persons elected as Associates between the 25th September in any year, and the 1st January in the following year, shall cover the year commencing on the said 1st January following.

(*c*) Subject to the special provisions, hereinbefore contained, every Associate shall be entitled, at any time during his Associateship, to compound for annual subscriptions then, or thereafter, at any time payable by him (including the subscription payable for the year in which he so compounds) by a payment to the funds of the Institute in one sum of £10 10s. 0d., and on such payment all further liability for contribution to the funds of the Institute except for entrance fee (if any) shall cease.

19. Provided always that any increase of fees, subscriptions, or composition money made by the Council, over and above what shall have been payable at the time of becoming an Associate, shall not affect any person who has become an Associate previous to such increase.

20. The failure of any Associate to pay his entrance fee, if one be payable, and if he shall not have compounded as aforesaid, or be exempt as aforesaid, the sum payable by way of subscription for the year of election within one month after his election, or if he shall not have compounded, or be exempt as aforesaid, his annual subscription as aforesaid within one month after the same shall have become payable as hereinbefore provided, shall render such Associate liable to have his name struck off the List of such Associates, and the Council shall be empowered to erase the name of any such Associate from the List of Associates, subject to the right of the Council to reinstate the name of any Associate whose name the Council shall have erased in any case in which the Council shall think fit so to do.

VII.—Designation of Associateship.

21. Any Associate desiring to designate himself as connected with the Institute as such shall be entitled so to designate himself by the description "Assoc. San. Inst."

VIII.—Resignation and Expulsion of Members and Liability to Contributions.

22. Any Member who may desire at any time to resign his membership, and who is not in arrear in the payment of the subscriptions payable by him to the Institute, according to the Rules for the time being, regulating the payment of subscriptions, may do so by letter, in writing, addressed to the Secretary, at the Office of the Institute, and thereupon as from the date at which such letter of resignation shall be received as aforesaid, the Member so desiring to resign shall cease to be a Member, and his name shall be erased from the List of Members.

23. Any Member whose subscription to the funds of the Institute for the year previous to any then current year, and for such current year, shall not have been paid on or before the 1st of March in such current year, shall be liable to have his name erased from the Register of Members, on the ground of non-payment of subscriptions; and if upon notice on behalf of the Institute given to such Member, requiring him to pay his subscriptions in arrear as aforesaid, he shall fail to pay the same according to the exigency of such notice, his name may, by resolution of the Council, be erased from the Register of Members, and if his name be so erased, such Member shall thereupon cease to be a Member. Provided always that a Member, who shall so cease to be a Member, shall nevertheless remain liable to pay the contributions, for the non-payment whereof his name shall have been erased from the list of Members as aforesaid. And provided further that, notwithstanding that the Membership of any Member may have become determined as aforesaid, the Council shall in any case in which they may think fit in their discretion so to do, have power in the current year in which the right of a Member to continue Membership shall have determined for non-payment of subscriptions as aforesaid, but not afterwards, by resolution to reinstate any such Member in his Membership upon his payment of all arrears of subscription, and he shall in such case and upon payment of arrears be reinstated as a Member accordingly.

24. Should any requisition signed by not less than twenty Members be transmitted to the Council requiring that any Member be expelled from the Institute, and stating the reasons or grounds on which such requisition is made, the Council shall, in case the reasons or grounds stated by the Requisitionists shall appear to the Council to afford a good and sufficient *prima facie* cause for the expulsion of such Member, cause to be forwarded a letter signed by the Secretary and addressed to the Member whose expulsion is required, and take all such other steps as they shall deem requisite for giving him a fair opportunity of denial, defence, or explanation; and in case the member in question shall decline or neglect to avail himself of such opportunity, or shall fail to satisfy the Council by his denial, defence, or explanation, the Council shall have power at a meeting of the Council called for the purpose of considering such expulsion, and consisting of not less than ten Members of Council (one of whom

shall be the President, or one of the Vice-Presidents, or the Chairman of the Council), to remove the name of such Member from the Register, and thereupon he shall cease to be a Member of the Institute.

25. All entrance fees and subscriptions to the funds of the Institute payable by any Member shall be a debt due from him, and until he pay the same he shall remain liable for the payment of the contributions payable by him to the Institute under the Regulations or Rules of the Institute for the time being with reference to the payment thereof.

26. In any proceeding by the Institute against any Member for the recovery of any contribution payable by him to the funds of the Institute, it shall be sufficient for the Institute to prove that the name of the person proceeded against is on the Register of Members and that such contribution remains unpaid, and proof of the matters aforesaid shall be conclusive evidence of the debt.

27. The Council shall at all times have power, in reference to the case of any Member who in the opinion of the Council has distinguished himself in the cause of Sanitary Science, but who from ill-health, advanced age, or other sufficient cause, in the opinion of the Council, is unable to pay his contributions to the funds of the Institute, to remit altogether the payment of the contributions and all arrears (if any) thereof, or to accept Books, or Drawings, or Models, or such other contributions, not being a money contribution, as in their opinion in the circumstances of the case may seem appropriate to accept in lieu of the contributions payable by such Member.

IX.—Forms of Application for Membership or Associateship.

28. The Council shall have power from time to time to determine and prescribe the forms of application for Membership and Associateship respectively, and also in any particular case to regard and treat as made or given, in the prescribed form, any application for Membership or Associateship which they may think fit to allow.

X.—General Meetings and Proceedings Thereat.

29. The first Ordinary General Meeting of the Institute shall be held at such time, not being more than four months after the Incorporation of the Institute, and at such places as the Council shall determine, and subsequent Ordinary General Meetings shall be held at such times and places as shall be from time to time, or by way of By-law, prescribed by the Council; and if no other time or place be prescribed for it, an Ordinary General Meeting shall take place at four o'clock on the last Tuesday in the month of January in each year at such place as may be determined on by the Council.

30. All other Meetings shall be called Extraordinary.

31. The Council may, whenever they think fit, and they shall upon a Requisition made in writing and signed by not less than fifteen Members, convene an Extraordinary General Meeting.

32. Any Requisition made by the Members shall express the object

of the Meeting proposed to be called, and shall be left at the Registered Office of the Institute.

33. Upon the receipt of such a Requisition the Council shall forthwith proceed to convene a General Meeting; and if they do not convene the same within twenty-eight days from the date of the receipt of the Requisition, the Requisitionists may themselves convene a Meeting.

34. Not less than seven days' notice of every General Meeting, specifying the place, the day, and the hour of the Meeting, and in case of Special Business, the general nature of the business to be transacted thereat, shall be given to each of the Members residing in the United Kingdom, in such form and manner as the Council may from time to time prescribe; but the accidental omission to give such notice to, or the non-receipt of such notice by, any Member shall not invalidate the proceedings of any General Meeting.

35. Every Ordinary General Meeting may, as ordinary business (when such election shall, under the Regulations, be part of the business of such Meeting), proceed to the election of the President, Vice-Presidents and Treasurer, for the ensuing year, the election of Members of Council in place of those retiring under the Regulations, and of Auditors, and may receive and adopt and confirm, either wholly or in part, any Report or Statement made to the Meeting by the Council, and the Accounts and Balance Sheets (if any) presented to the Meeting, and may decide on any recommendation made in any Statement or Report of the Council or any question arising out of the matters aforesaid. All other business, whether transacted at an Ordinary or Extraordinary Meeting, shall be deemed special, and cannot be entered upon unless specified in the notice convening the Meeting; and any Member desiring to bring forward any business at an Ordinary Meeting must give not less than six weeks' notice thereof to the Council, who may, if they think fit, specify the same in the notices convening the Meeting.

36. An Honorary Fellow may attend and speak in any General Meeting, but shall have no vote.

37. No business shall be transacted at any General Meeting except the election (when necessary) of a Chairman, unless a Quorum of Members be present at the time when the Meeting is prepared to proceed to business.

38. In order to constitute a Quorum at a General Meeting there shall be present at least six Ordinary Members.

39. If within half an hour from the time appointed for the Meeting a Quorum of Members be not present, the Meeting shall, if convened upon the requisition of Members, be dissolved, and in any other case shall adjourn to some time (not later than the twentieth subsequent day) and place to be fixed by the Members present, of which three days' notice at the least shall be given; and if at such adjourned Meeting a Quorum be not present, the Member or Members present may proceed to the transaction of the business.

40. At every General Meeting all matters which come under the consideration of such Meeting shall, unless it shall be in any case

otherwise provided, or unless where otherwise by law required, be decided when the vote is not unanimous by a simple majority of the votes of the Members personally present. The Vote to be taken by a show of hands or by dividing the Meeting as the Chairman shall decide, unless a division be demanded by at least six Members.

41. The President or in his absence the Senior Vice-President, or in case two or more Vice-Presidents of equal standing shall be present, such one of them as shall be chosen by the Members present, or in the absence or unwillingness to act of the President and all the Vice-Presidents, the Chairman of Council, or in his absence or unwillingness any Member chosen by the Members present, shall preside as Chairman at any General Meeting.

42. The Chairman may, with the consent of the Meeting, adjourn any General Meeting from time to time and from place to place, but no business shall be transacted at any Adjourned General Meeting other than the business left unfinished at the Meeting at which the adjournment took place.

XI.—Votes of Members.

43. Every Member shall, upon a show of hands or Division, have one vote only. In case of an equality of votes, the Chairman shall have a second or casting vote.

XII.—The President, Vice-Presidents, and Treasurer of the Institute, and Mode of Their Election.

44. Among the Fellows of the Institute there shall be one who shall hold and bear the title, and discharge the duties of President of the Institute; and unless and until the Institute in General Meeting shall otherwise, either by special or extraordinary Resolution so resolve, there shall be two or more Fellows who shall respectively hold and bear the title and discharge the duties of Vice-President of the Institute; and there shall also be elected from among the Fellows of the Institute one who shall bear the title and discharge the duties of Treasurer of the Institute.

45. The first President, Vice-Presidents, and Treasurer of the Institute shall be elected at the First General Meeting of the Institute to be held after its incorporation, and they shall respectively hold office until the Ordinary General Meeting of the Institute, or, if more than one, the first Ordinary General Meeting of the Institute to be held in the year next but one after the year of incorporation, or such other Ordinary General Meeting as shall be determined at the time of their election.

46. At the Ordinary General Meeting until which a President, Vice-President, or Treasurer is to hold office, the office which he vacates is to be filled until such subsequent Ordinary General Meeting as shall then be determined, or, if no other shall be so determined, then until the only or first Ordinary General Meeting in the following year, and [subject to the provisions of the next article] a retiring President, Vice-President, or Treasurer shall be re-eligible.

47. The President shall not be eligible for re-election more than twice in succession.

48. The President and Vice-Presidents shall, if more than one name for each office be proposed, be elected by ballot.

49. Not less than three weeks previous to the General Meeting at which the President and Vice-Presidents are to be elected, the Council shall send by post or deliver to every Member a list of Members suitable for proposal to the offices of President and Vice-Presidents respectively; and the name of any other Fellow not in such list, if proposed by any two Fellows and sent to the Council not less than two weeks before such General Meeting as aforesaid, with a written undertaking by the nominee of such Fellows to serve if elected, shall be added by the Council to their said list; and the list sent out by the Council with any other name or names proposed as aforesaid shall be the Balloting List for the election of President and Vice-Presidents respectively.

50. In case, for any reason, or by any inadvertence whatsoever, the election of President, Vice-Presidents, or Treasurer shall not be made at the General Meeting or any adjournment thereof, at which in due course it ought to have been made, the Member, or Members, discharging the office, or offices, with reference to which there shall have been such failure of election as aforesaid, shall be considered as continued in office until the next period of election.

XIII.—The Council and its Powers.

51. Until otherwise determined by the Institute in General Meeting, the Council shall consist of not more than 31 nor less than 21 elective Members, and also the President, Vice-Presidents, Treasurer, and Registrar as *ex officio* Members.

52. The first elective Members of Council shall be such persons as at the date of the incorporation of the Institute shall be elective Members of the Council of the Parkes Museum, or of the Council of the Sanitary Institute of Great Britain respectively, and they shall hold office until the first Ordinary General Meeting in 1889.

53. At such last-mentioned Meeting, and at every subsequent first Ordinary General Meeting of the year, eight of the elective Members of Council shall retire from office, and a like number of Fellows shall be elected to fill the vacated offices.

54. Four of the retiring Members of Council shall not be eligible for re-election until the next Ordinary General Meeting following their retirement.

55. The Members of the Council who shall retire at the first Ordinary General Meeting in the year 1889, and at the first Ordinary General Meeting in every subsequent year thereto, shall be determined as follows:—

(*a*) The four retiring Members who are not eligible for re-election shall be determined by vote of the Council by ballot.

(*b*) The four retiring Members who are eligible for re-election shall be those amongst the remaining Members (after

excluding those determined by Clause 55*a*) who have been longest in office, and whenever, by reason of the number of Members who have been in office for the same period that test shall fail, the individuals of the class who are to retire shall be determined by drawing lots.

56. Any vacancy by retirement or otherwise existing at the time of the Ordinary General Meeting, at which elections are to take place, or of any adjournment thereof, shall be counted as one of the vacancies to be provided by the retirement of the four Members not eligible for re-election, provided always that, subject to previous notice being given, any such Meeting may reduce the number of the Council by the number of vacancies, or any less number.

57. Unless and except so far as it shall be resolved to reduce the number of the Council at the Ordinary General Meeting at which Members retire, then, in case such meeting or any and every adjournment thereof shall fail to elect successors to all the retiring Members, such retiring Members, or such number of them as with the successors elected will make up the entire number of retiring Members, shall continue to act as if they had been re-elected at such Meeting, the retiring Members who are so to continue being determined by the Council by ballot.

58. The powers of the Council shall not be affected by vacancies and all acts done by any Meeting of the Council, or of a Committee of the Council, or by any person acting as a Member of the Council shall, notwithstanding that it be afterwards discovered that there was some defect in the appointment of any persons or person acting as Members, or a Member of the Council at such Meeting or otherwise, or that they or any of them were or was disqualified, be as valid as if every such person had been duly appointed and was duly qualified to act.

59. Only Fellows shall be elective Members of Council, and any Member of the Council shall vacate such office in case he shall cease to be a Member of the Institute.

60. A Member of the Council may at any time give notice in writing of his wish to resign, and on the acceptance of his resignation by the Council, but not before, his office shall be vacated.

XIV.—Powers of the Council.

61. Subject to the Regulations the Council shall meet for the despatch of business, adjourn and otherwise regulate their Meetings as they shall think fit; and the Quorum necessary for the transaction of business shall, unless and until the Regulations otherwise provide, be five, and questions arising at any Meeting of Council shall, unless and until the Council shall otherwise determine either generally or with reference to any particular case, be decided by a simple majority, and in case of equality of votes the Member acting as Chairman of the Meeting shall have a second or casting vote. Any two Members of Council may at any time summon a Meeting of Council.

62. The President of the Institute shall be entitled to preside and act as Chairman at every Meeting of Council if and when present, or in his absence one of the Vice-Presidents, and if more than one Vice-President shall be present, then such one of them as shall be selected by the Meeting shall be entitled to preside as Chairman.

63. The Council shall have power to elect annually from among the Members of Council a permanent Chairman, who shall when present preside as Chairman on all occasions on which both the President and the Vice-Presidents shall be absent, and in the absence of President, Vice-Presidents, and permanent Chairman, a Chairman *pro hac vice* shall be elected by the Meeting.

64. Casual vacancies occurring among the elective Members of Council may be filled up by the Council.

65. The entire business of the Institute shall be arranged and managed by the Council, who may exercise in all respects all the powers of the Institute, save such as are by law, or by the Regulations declared to be exercisable only by the Institute in General Meeting. The generality of the power hereby conferred shall not be deemed to be limited by any express powers conferred on the Council by the Regulations, and no new Regulation or resolution of a General Meeting shall invalidate any prior act of the Council, which would have been valid if such Regulation had not been made or resolution passed.

66. Particularly, and without limiting or controlling the effect of the preceding Article, the Council may :—

(*a*) In case of any casual vacancy occurring in the office of President, Vice-President, or Treasurer of the Institute between the periods at which, according to the Regulations, the President, Vice-Presidents, and Treasurer are to be elected, elect a Member to fill any such casual vacancy until the next regular period of election.

(*b*) Elect from among the Fellows of the Institute, and appoint a Registrar of the Institute, and determine or agree with the Registrar as to his remuneration. So far as the Council may think fit so to do, regulate, limit, and define the duties of the Treasurer and Registrar respectively; but such duties as to the Registrar shall comprise the keeping of a Register of Candidates who have passed the examinations and obtained Certificates from the Institute, and the preparation in concert with the Board of Examiners of a Report of each Examination to be submitted to the Council. The Registrar shall be appointed annually, but shall always be re-eligible.

(*c*) Elect from among the Fellows of the Institute the several Members who shall constitute the Board of Examiners to conduct the Examinations to be held by the Institute.

(*d*) Elect and appoint the Judges of the Exhibitions to be held by the Institute.

(*e*) Determine the time, place, and mode of holding the Examinations for Certificates of competency, and other

Certificates of the Institute, and the subjects on which Candidates shall be examined, and the conditions under which Candidates shall be entitled to present themselves for examination.

(*f*) Regulate and determine the fees payable by Candidates for Examination, and the conditions under which any of the Prizes offered by the Institute may be competed for by Candidates.

(*g*) Determine how and in what proportions, and to or between whom the fees paid by Candidates for examination shall be paid or divided, or how otherwise the same shall be applied. Provided always that no Member of Council shall vote upon any question in which his remuneration for services rendered or to be rendered by him to the Institute as Examiner or otherwise is to be determined.

(*h*) Draw up for the purpose of presenting the same at General Meetings all such Reports and recommendations, or statements of the affairs of the Institute and all such Statements of Account as they shall think fit.

(*i*) Publish and edit, or cause to be edited and issued in the name and on behalf of the Institute all such Books, Papers, Periodicals, or other literary productions connected with Sanitary Science as to the Council shall seem fit.

(*j*) Accept for, and on behalf of, the Institute either solely or subject to such reservation of copyright, or otherwise, as may be agreed, any book, picture, drawing, periodical, literary production, or other work.

(*k*) Appoint a Secretary and such other Officers and Assistants of the Institute as they shall deem requisite, and fix the amount of the salaries or remuneration of any Officers of the Institute and the duties from time to time to be performed by them respectively; and delegate to any Officer of the Institute whether paid or honorary, or to any Committee consisting of such number of Members of their body as they shall determine, such powers of the Council, either in respect of the appointment of Officials or Servants, or otherwise as the Council may think fit to be so delegated.

(*l*) Purchase, acquire, adapt, or erect from time to time on behalf of the Institute all such sites, not exceeding in the aggregate two acres, and buildings as they may think necessary or convenient for the purposes of the Institute, and for such purposes enter into all necessary contracts, and ratify any provisional or other contracts entered into before the incorporation of the Institute, and offer any premium or premiums for designs of buildings adapted for the purposes of the Institute.

(*m*) Agree to all terms, assume all liabilities, and do all acts necessary or proper with reference to taking over all or

any of the assets and liabilities of the Parkes Museum, and the Sanitary Institute of Great Britain, or either of them.

(*n*) With authority of a General Meeting, but not otherwise, borrow on Mortgage of all or any part of the present, or the future property of the Institute, or on the Debentures or Promissory Notes of the Institute (such Promissory Notes to be signed on behalf of the Institute by two Members of Council and countersigned by the Treasurer and Secretary), any sum or sums of money which they may think proper, and apply the money so raised to the purposes of the Institute, and in every Mortgage made in pursuance of this power, if they think fit, insert a power of sale, and all usual or proper Mortgage powers and provisoes.

(*o*) With the authority of a General Meeting, but not otherwise (except as to sales of moveable property no longer required, or for the purpose of being replaced), sell or dispose of any land, buildings, or other property belonging to the Institute.

(*p*) Make, and from time to time afterwards repeal or alter all such By Laws for the conduct of the general affairs of the Institute, and for the despatch of business as the Council, from time to time may deem expedient, provided that such By Laws do not contravene any of the Regulations.

(*q*) Without prejudice to the generality of sub-clause (*p*), it is expressly declared that such By Laws may determine the cases in which the Council shall vote by ballot, and the Quorum or majority of votes which shall be required in any particular case, and may impose conditions as to the qualification of Fellows, Honorary Fellows, Ordinary Members, Associates, and the mode of proposing them, and may provide for suspending the privileges of persons whose subscriptions are in arrear, and may prescribe the mode of proposing, voting for, and electing the President, and Vice-Presidents of the Institute, the elective Members of Council, the Auditors, and the Treasurer, and may provide for the appointment of Trustees of the Institute by General Meetings if any such are required.

67. The Council shall provide a Common Seal, and shall have full power to use the said Seal in the execution of all, or any of the powers hereby vested in them, or otherwise in relation to the business or affairs of the Institute, as they, in their discretion, think fit: and any document bearing the Seal of the Institute, and purporting to be attested by two Members of the Council shall, in the absence of proof to the contrary, be deemed to be duly sealed by the Institute.

68. Members of Council shall be paid all actual outlay on behalf of the Institute incurred by order of, or sanctioned by, the Council.

69. The Council are authorized, out of the moneys of the Institute, to pay such sum of money as they may think fit, in discharge of all

expenses (preliminary or otherwise) attending or incidental to the formation and incorporation of the Institute.

70. All moneys received by, or on behalf of, the Institute, shall be regularly paid into the banking account, to be kept in the name of the Institute, and no money shall be paid by or on account of the Institute other than petty cash disbursements, except by cheque on the said banking account. Petty cash disbursements shall be paid out of cash for which cheques on the said banking account shall be drawn, from time to time, as required. All cheques on the said banking account shall be signed and countersigned as may, from time to time, be directed by the Council.

71. The Council shall cause Minutes to be made of all proceedings at any Meeting of the Institute or of the Council, and shall at all times cause a register to be kept of the Members, both Ordinary Members and Fellows, and a list of Honorary Fellows and Associates, with their respective last known places of abode.

XV.—Accounts and Auditors.

72. The Council shall appoint two Auditors, one of whom shall be a member of the Institute of Chartered Accountants, to audit the accounts of the Institute, to be presented to the Members at the first Ordinary General Meeting to be held in the year 1889; and at such Meeting, and thenceforth at the first Ordinary General Meeting in every subsequent year, two Auditors, one of whom shall be a Member of the Institute of Chartered Accountants, shall be appointed for the ensuing year to audit the accounts of the Institute.

73. An Auditor need not necessarily be a Member of the Institute, and a Retiring Auditor shall be re-eligible, and the Council may supply any casual vacancy in the Auditorship.

74. The Council shall cause true accounts to be kept of the receipts and expenditure of the Institute, and of all such matters as shall be necessary to show the true state and condition of the Institute financially, and shall cause the accounts of the Institute to be audited annually by the Auditors appointed pursuant to Regulations, and such Auditors shall have access at all reasonable times to the Books of the Institute, and shall verify and sign any Annual or other Statement of Account submitted by the Council to General Meetings.

XVI.—Notices.

75. Notices required to be given by the Institute or the Council to the Members may be given either personally, or by leaving the same for, or by sending the same through the post addressed to the Members at their Registered places of abode respectively. All Notices, if given by post, shall be deemed to have been given at the time when the letter containing the same, being properly addressed and posted, would have arrived in due course of post.

76. All Notices required by law to be given by advertisements shall be advertised in a newspaper circulating in London, and shall be deemed sufficient if so advertised.

Names, Addresses, and Description of Subscribers.

NORTHUMBERLAND. 2, Grosvenor Place; Peer of the Realm.

WESTMINSTER. Grosvenor House; Peer of the Realm.

DOUGLAS GALTON, K.C.B., late Royal Engineers. 12, Chester Street, Grosvenor Place, S.W.

GEORGE JAMES SYMONS, F.R.S., Meteorologist. 62, Camden Square, N.W.

THOMAS HAYTER LEWIS, F.S.A. 12, Kensington Gardens Square.

MARK HAYLER JUDGE, A.R.I.B.A. 8, Park Place Villas, W.

WILLIAM HENRY CORFIELD, M.A., M.D. (Oxon). 19, Savile Row, W.

THOMAS TWINING, Gentleman. Perryn House, Twickenham.

EDWIN CHADWICK, C.B. East Sheen, Mortlake, Surrey.

ROGERS FIELD, B.A., M.Inst.C.E. 4, Westminster Chambers, S.W.

T. ORME DUDFIELD. 14, Ashburn Place, S.W. (Doctor in Medicine).

CHARLES H. PARKES, Gentleman. Netherfield, Weybridge.

CHARLES E. CASSAL, F.I.C., F.C.S., Public Analyst. Town Hall, Kensington.

G. V. POORE, M.D., F.R.C.P., Physician. 30, Wimpole Street, W.

Dated the 16th day of August, 1888.

Witness to the above Signatures,

E. WHITE WALLIS,

Secretary of the Sanitary Institute of Great Britain, and of the Parkes Museum, 74a, Margaret Street, W.

LECTURE

By Sir Douglas Galton, K.C.B., D.C.L., LL.D., F.R.S.

Read December 6th, 1888.

My object in addressing you to-night, is to lay before you the hopes which have animated the Council in carrying into effect the amalgamation of the Parkes Museum and the Sanitary Institute of Great Britain.

Although it is scarcely necessary on the threshold of my address to justify our existence, yet I think that it will be of advantage to our new Institute to dwell for a moment upon the extensive area which sanitation covers, and to draw your attention briefly to the large extent to which sanitation, properly understood, enters into our daily life.

Dr. Parkes' admirable teaching, which he subsequently condensed in his book on Hygiene, may be said to have laid the foundation of Hygiene as a science in a complete form, for it was the first effort, in this country at least, to collate into one harmonious whole, the various laws relating to what may be termed Preventive Medicine.

The Parkes Museum was founded in commemoration of this effort.

Soon after the foundation of the Parkes Museum, Mr. Thomas Twining drew up a most interesting synopsis to explain and to keep prominently in view the various matters which it was the object of the Museum to illustrate.

It is well to recapitulate them here briefly under the several heads under which he enumerated them.

1. *Engineering and Local Hygiene.*—Under this head he included climatology, and causes of disease and death-rates appertaining to physical geography; information on health resorts: botanical hygiene; geology as bearing on salubrity and water supply; plans for the healthy arrangement of towns; principles of town drainage, water supply, scavenging, and disposal of refuse, &c.

2. *Architecture.*

(*a.*) Designs and models connected with health in dwellings of every sort, factories, workshops, schools, &c.

(*b.*) Materials and details of construction.

3. *Household Requisites*, including fixtures and furniture, and embracing all matters connected with lighting, warming, cooking, cleaning, and other domestic sanitary purposes.

4. *Clothing*, embracing materials, shape, climatic influences, &c.

5. *Food.*—Chemistry of food, and value for nutrition, as obtained either from the animal or from the vegetable kingdom. Beverages. Dietaries.

6. *Preservation and Relief.*

(*a*). Personal hygiene.

(*b*). Protection and rescue, including protection against disease, poison, dangerous insects. Life-boats. Fire-escapes. Lightning Conductors, &c.

(*c*). Industrial pathology, or the prevention of accidents, injuries, and diseases incidental to Industrial employments.

(*d*). Special hygiene of professional occupations.

You will thus see that the subjects which our Institute would illustrate are spread over the principal proceedings of our daily life.

It is not that sanitary knowledge in itself is by any means new, but our progress in what we term our civilization has developed various new contingencies attending our mode of living, which have altered the conditions which affect the application of sanitary knowledge, so that the want of an institution such as ours has come to be widely felt.

When we look around upon our rapidly increasing population, which is gradually occupying every piece of spare land in this small country; when we look at our Colonies, where sites abounded which with ordinary prudence might have been kept in a healthy condition, but in which ignorance and carelessness have in some cases produced, and in other cases may produce, conditions causing widespread disease and death; when we look at India, where under our regime above 38,000,000 have died in the last ten years from preventible diseases; when we reflect that every one of these deaths represents numerous cases of sickness, and that on a very low calculation the fever deaths alone would represent in fever attacks several times over the entire population of India, and all the loss of working power which fever attacks entail; when, I say, we consider these various facts, we feel that, great as are the advantages conferred upon us by the various societies which exist for pushing forward our knowledge

of different branches of science, such as geology, astronomy, entomology, botany, &c., yet that our Society, the Sanitary Institute, will yield the palm to none in respect of the advantages which, under proper direction, it will confer upon humanity.

What a wide field is open to us to labour in!

In looking around at our mode of life in this country, at our habits, our dwellings, is there not on every side an opening for instruction in, or for comment upon, the violation of sanitary knowledge?

For instance, look at the hecatombs of infants yearly sacrificed to our mismanagement.

The Registrar-General tells us that in last October the deaths of infants in London averaged 164 per 1000 born.

In provincial towns the mortality was greater; thus, in twenty-seven large towns, it averaged 227 per 1000 born.

In Sheffield it was 279 per 1000 born.
„ Leeds „ 294 „ „
„ Leicester „ 359 „ „

Amongst the many causes which lead to this sacrifice of infant life, ignorance of the elements of hygienic treatment is the main cause, and especially ignorance in feeding; for many babies are given food that an adult could ill digest.

But there lies a deeper question at the root of our infant mortality. It is not amongst the well-to-do classes that this wholesale slaughter prevails.

Why are such numbers of children born? Why have we allowed our population to grow up, herded together like the beasts of the field, without moral training or self-restraint?

When we look around at the masses of people congregated together in London and in our large towns, we feel in despair as to what methods to pursue to induce them to regulate their lives according to the principles of health and morality.

It would have been comparatively easy to have done so before the communities had attained their present gigantic proportions, had some far-seeing legislator recognised the importance of regulating the lives of those who dwelt together in communities; but whatever are our present difficulties, we may feel sure that they are less than those which will fall to the lot of our successors if we neglect now to grapple with them.

One of the main causes of the evils which arise from our congested population has been the utter neglect which has been allowed to prevail in respect of the condition of their dwellings.

No doubt the problem of how decently to lodge our population is fraught with difficulty; but we may safely assume as an axiom, that where aggregations of population are permitted to prevail, they must be regulated by laws which will prevent the

prevalence of habits amongst them which favour the propagation of disease.

The experience of our large provincial towns shows that it rests entirely with the governing body of the town to regulate the health conditions of the population; and the more closely we consider the application of sanitary laws to the dwellings of the poorer classes, the more apparent does it become that amongst dense populations it is as necessary to exercise supervision over the occupation of the dwellings as over their construction. We must hope that the new County Council for London may be able to take this matter in hand, and to give an impulse to the movement for improving and regulating the dwellings of the labouring classes, such as has produced useful results in the self-governed towns of Glasgow, Newcastle, and elsewhere.

There is another question connected with the health of London, and indeed of many other large towns, which through our neglect has grown to undue proportions. I mean the pollution of the air: first by means of fog, which is partly the creation of the dust which arises largely from the vast quantity of manure which we retain in our midst; and, secondly, by means of smoke, which blackens that fog, and is the result of our selfish system of burning crude fuel in our fire-places.

Among subsidiary matters which affect our health the question of Dress stands prominent.

As Architecture is the art and science of building, so Dress is the art and science of clothing. To construct and decorate a covering for the human body, that shall be beautiful and healthy, is as important as to build a shelter for it when so covered that shall be also both beautiful and healthy.

To build a healthy dress we must have not merely proper materials and sound construction, but the heating and ventilation should be carefully considered. Thus in a cold climate the dress should retain the heat of the body, and in a hot climate it should shield the body from the heat of the sun; but in both cases the dress should allow exhalations to pass freely away.

As health depends upon the free circulation of the blood, the dress should not be so tight as to impede this; nor should it be so loose as to compel the needless multiplication of garments.

Pure wool seems to fulfil hygienic conditions better than other textiles. It is a non-conductor of heat, and it absorbs and distributes the moisture from exhalations. Cotton, though inferior to wool, is superior to linen as a non-conductor, but it is a very poor absorbent; while linen is a rapid conductor, attracts moisture, and has a very low radiating power. In addition to material and texture, the sanitarian must consider

colour in dress; in regard as much to the dangers arising from poisonous colours, as to the effect of colour on heat and radiation.

A costume should be calculated to increase the functional powers of the body, and to perfect the action of the skin; and, moreover healthy or hygienic dress should have beauty of form and cut to recommend it; for health without beauty is after all a mere compromise with disease.

There is another subject which presses urgently for recognition, viz., the sanitary side of education.

One of our Vice-Presidents, Dr. B. W. Richardson, has long advocated the importance of founding the basis of national education upon the national necessities, which he has enumerated to be as follows:—That although in early youth the three simple elements of learning, viz., reading, writing, and calculating, are necessities, they will be comparatively valueless unless combined with further necessities of a physical kind. These are, first, sound and systematic muscular training, to ensure freedom of breathing and circulation of the blood, so that the body can be structurally built up and sustained in health; and secondly, preparation for duties requiring precision, decision, presence of mind, and endurance, and readiness for acquiring crafts or handicrafts that may bring a useful living. In a word, education should bring the mental and physical qualities into harmony.

Weighed by this standard, the present methods of teaching introduced by the code are injurious—mentally, bodily, and morally.

In the case of the children, they are not only a violation of physiological, but of psychological law.

The powers of receptivity of the minds of children of different ages, that is, their capacity for attention and retention is measureable. Certain brains can take in so much, and no more, according to age. The capacity grows with cultivation and skilful teaching, no doubt; but it must be permitted to grow. In the very young a lesson of a minute may be all-sufficient. Later, of three minutes, five, ten, fifteen, and so on, to one hour, two, or three. But to this there is a limit; and physiologists tell us that, although the receptivity varies in different children according to difference of temperament, physical health and build, the receptivity at one time, in all children, ceases at the end of three hours.

Even this degree of the receptivity of the brain is lowered by insufficient food.

It has become a burning question as to how both to compel the attendance of the poorer children at Board Schools, and to

ensure that they shall have received an adequate meal before they commence their brain work.

This question has been solved in a sensible and practical way in Paris.

In Paris primary education is free, and no fees have to be paid by the parents; but inasmuch as it is compulsory, the authorities hold that it is directly to the interest of the community at large that the children should not only be forced to go to school, but that they should attend in such a physical condition as to be able to take advantage of, and not be injured by, the teaching. Parents in Paris who fail to send their children to school are not summoned before a police magistrate ; they are required to give an account of themselves to the *Commission scolaire*, which is composed of ordinary citizens in the *arrondissement.* If it is then found that the father and mother are really too poor to provide the children with proper clothes and boots in which to go to school, then such boots and clothes are at once provided for the children gratuitously.

"Cantines Scolaires"—school kitchens—have been established in connection with some of the schools, to provide meals for the children. For these meals ten centimes each (say a penny) is paid, the food being cooked on the spot. The distribution is managed in this way. Each child goes up to the teacher in turn, and receives its ticket in return for its penny. If, however, any child is too poor to be able to pay the penny, the teacher is informed of this beforehand, and the poor children receive their tickets in precisely the same way and at the same time as those whose parents have been able to pay for them, nor is it known to their companions that they are in receipt of free meals.

The education of a mental kind now being supplied will be imperfect, and may be dangerous, unless it be so combined with physical culture that a perfect, or comparatively perfect, health of body shall go with it.

Indeed, education should be so distinctly physical, that the body should be in no respect less improved than the mind at the close of the educational career.

I will quote this further remark from Dr. Richardson :—

"The education of the young of all classes, and of the poorest classes chiefly, should be so framed as to lead to the inducement of making the acquisition of knowledge a taste instead of a task, a pursuit instead of a labour: and to this end the subject of recreation should be made a scientific branch of study amongst all who are engaged in educational work."

In the case of boys their sports and occupations may easily be so directed as to ensure this result.

With girls, who seldom practise games of this nature, the use of trained physical exercises is more important, in order to bring all parts of the body into play, and thus to set up equal circulation, distribution of nervous power, and nutrition, without any part being overtaxed.

Such systematic training would prevent much of that physical weakness and consequent ill-health amongst women which is the cause of much domestic misery. Moreover, it has been wisely and truly remarked that "with the feebleness of the mother begins the feebleness of man."

Again the sanitary problem is as much concerned with the food of the population as it is with the dwellings.

Our Museum contains a collection made by Mr. Twining of samples of food.

We require food of a certain character, which is known as nitrogenous food or albuminates, for the purpose of building-up the tissues of the body in the time of growth and repairing them in the time of adult life and old age. And, secondly, we require other food, which is generally called non-nitrogenous or carboniferous, which has to be consumed in the body by means of the oxygen in the atmosphere, in order to form that amount of energy which is necessary both to support the animal heat of the body and also to produce actual visible practical work. Besides that, we require other substances, such as mineral salts, which are necessary for carrying on the functions of digestion and regulating the way in which the different constituents of the food are taken up and assimilated.

And, in addition to all these, we may say there is still another class, such as the acids which are present in fruits and in vegetables, and whose absence produces the disease called scurvy, which has by no means disappeared from the community at the present time.

The knowledge of the uses and value of these different constituents of food, enables us so to frame our diet as to draw, under varying circumstances of climate and supply, the most effectual advantage from our sustenance.

But food is subject to various contingencies which regard our health.

There are dangers which may be concealed both in animal and in vegetable food arising from occult forms of disease; and there is little doubt that some descriptions of food are favourable vehicles for the propagation of certain diseases. This seems to be especially the case with regard to the spread of enteric and scarlet fevers through the agency of milk.

That milk should present such dangers is indeed unfortunate, for milk has been termed the "model food." Pure milk is the

natural food of infants, and in many cases the most appropriate food for invalids; and it may be said to contain every element which is essential to the growth of a healthy race of men and women.

We have also to protect the constituents of our food against adulteration.

Adulteration may be described as the act of debasing articles for pecuniary profit by intentionally adding thereto an inferior or deleterious substance, or by taking therefrom some valuable constituent.

On sanitary grounds the adulteration of food merits the severest condemnation, even when the substance added merely reduces the nutritive value or characteristic property of the food; but the offence becomes highly criminal when the adulterant also possesses properties injurious to health.

It is the poorer classes who have ever been the greatest sufferers from adulteration of food.

No doubt the most crying evils from which they suffered have been removed by the legislation of recent years. Yet much still remains to be done. Milk continues to be largely adulterated. The number of samples of adulterated milk, purchased by the inspectors under the Adulteration Act, are almost or quite as numerous as the adulterated samples of every other kind of food put together.

Sanitary science, having taught us to select our diet, further leads us in the next place to prepare it for use.

We have still much knowledge to spread respecting the science of cookery. I do not say to learn, because nearly one hundred years ago the subject of cookery was scientifically investigated by a man who began life as a poor schoolmaster, who became a great general, a great statesman, a great scientific man, and who was Dictator and Governor of Bavaria for a while. Benjamin Thompson, better known as Count Rumford, investigated cookery, and applied the science of cookery to the art; for great as he was in war, and great as he was in statesmanship, that which he evidently regarded as his greatest triumph was his economical cookery—the fact that he fed the poor of Munich, the beggars, thieves and vagabonds, which abounded there to a fearful extent, for less than a 1d. per day, with good nutritious and appetising hot food. The daily dinner provided by him at the House of Industry for 1200 persons, each receiving a portion weighing twenty ounces, cost altogether £1 15s. $2\frac{1}{2}$d., about one-third of a penny each—$\frac{422}{1200}$ of a penny exactly.

Count Rumford was the founder of the Royal Institution of Great Britain, whose charter dates from the 13th of January,

1800. As a portion of this large project, the founder of that institution had in view something closely similar to what the Parkes Museum has attempted to realise. Mere descriptions he knew were insufficient to interest and instruct the public. The public demanded something visible and tangible, and he therefore proposed that the Royal Institution should be made a repository for models of all contrivances and inventions which are calculated to promote the health, comfort, and general well-being of rich and poor.

His list embraces all the objects which we have at heart, as well as the diffusion of knowledge therein by means of appropriate lectures.

As regards these technical objects, the scheme of Count Rumford did not succeed; though, thanks to the genius of the great men who have been its professors, the Royal Institution has flourished in other directions.

We hope to succeed where Rumford failed; because, first, the scheme of the Council is a more manageable one; secondly, because public opinion has been acted on since Count Rumford's time by that period of latency, that process of permeation, which was wanting in Rumford's case.

Public education in sanitary matters has reached a level that makes the Parkes Museum answer to a public demand. It is the direct outgrowth of public needs, and will, we trust, as such, enjoy a permanence greater than it could enjoy as a cut-and-dried institution superimposed upon the public.

I have given you a brief synopsis of some of the important questions which are included in the work of the Sanitary Institute and the Parkes Museum, as educators of the nation in sanitary knowledge.

Let me now proceed to explain what is our future programme.

Our progress hitherto has been tentative. The original ideas which led to the foundation both of the Parkes Museum and the Sanitary Institute of Great Britain were to foster and to diffuse sanitary knowledge; and by the light of our experience, I think that we are now able clearly to see the direction in which we may extend our operations, and obtain useful results.

The holding of examinations has been one of the most important of the functions of the Sanitary Institute of Great Britain.

We have examined above 630 candidates, and granted certificates to 57 surveyors and 347 sanitary inspectors during the past twelve years.

These examinations have done a great deal towards raising

the standard of knowledge required from sanitary inspectors; they have also brought to light the fact that there are many men holding appointments who are lamentably ignorant of their duties.

The value of these examinations has been recognised by Local Boards and by the candidates themselves all over the kingdom; but many persons are deterred from coming forward for examination by the expenditure of time and money required for the journey to London, and the necessary stay of three or four days.

We hope that we may be able to overcome this difficulty by arranging for local examinations to be carried on in all the chief centres of England, on the same lines as those in London; and besides this to add to the examinations already held, others suitable for different appointments requiring sanitary knowledge, such as—

Port Sanitary Inspectors;
Trade Masters;
Builders or Clerks of Works;
Schoolmasters and School Inspectors;
Nurses;
Town Mission Workers, &c., &c., &c.

The Examinations brought into prominence the important fact that there is at present no school in the country where systematic sanitary teaching is available for either Surveyors or Sanitary Inspectors. The Parkes Museum consequently instituted classes for the Sanitary Inspectors. These classes were first commenced about three years ago; a course of twelve lectures was arranged, and delivered by leading Sanitary authorities, upon Sanitary Law, House Drainage and Water Supply, Cubic space and Ventilation, Scavenging, and other subjects cognate to the duties of Inspectors of Nuisances. The numbers who have taken advantage of these lectures have continuously increased: 65 students entered for the first course, whilst for the course held during the past autumn the entrances numbered 114. These results show how eagerly such instruction is sought for. But persons living at a distance from London are quite unable to attend these classes; and the Institute aims at establishing similar classes in the provinces to precede the local examinations referred to. It also aims at devising other courses of instruction suitable for Local Surveyors and for the other appointments for which examinations are suggested.

I am extremely anxious that the new courses should include lectures which would be available for those students who have received appointments in the Indian Civil Service.

I will explain why I advocate this.

The sanitation of India is in a deplorable condition. A

quarter of a century ago Lord Herbert of Lea caused a Royal Commission to be appointed to enquire into the sanitary condition of the Indian army; that Commission found that the death-rate of the army in India averaged 69 per 1,000.

In Bengal from 1830 to 1845 the deaths from zymotic diseases had averaged 58 per 1,000. These evils have been corrected, and the death-rate in the Indian army has, in late years, varied from 10 to 15 per 1,000; but further improvement in the health of the army in India is contingent upon improved sanitary arrangements amongst the native population.

No doubt some improvement in the sanitary condition of the native population has taken place of late years, but you have only to read the reports of the Sanitary Commissioners of the various Presidencies and Districts to see for yourselves that the sanitation of the native population of India, including Calcutta, remains a disgrace to English methods of administration.

But this matter would not be one of insuperable difficulty if we could only ensure that the necessities of India in respect of sanitation should be recognized.

It is not so much a matter of money as one of knowledge and will. There are numerous English civilian officers spread over the whole of India, who administer the revenue; and if these officers received some instruction in practical sanitary knowledge before they went out to India, and as an integral part of their education, we should in a very few years have a large amount of sanitary knowledge spread over the whole of India, and in possession of the very class whose duties would enable them to see how it could be applied with the best effect.

The neglect of sanitary laws which now prevails so universally, arising largely from ignorance, would thus be checked; and I do not hesitate to say that with increased sanitary knowledge in the ruling class in India the present conditions would be changed. Fevers, and other preventible diseases, which now almost decimate the population, would be checked. Cholera would no longer continue to be an endemic disease in India any more than typhus fever is now in this country.

I am therefore desirous of so framing our courses of lectures on sanitary knowledge, and following them by examinations, that we may afford opportunities of education to this class of students, in addition to those for whom we have already provided.

We trust also to organise demonstrations of hygienic apparatus for medical men, as well as courses of Domestic Hygiene for ladies.

We should propose eventually to supplement our courses of lectures by developing in connection therewith such laboratories

for practical work as experience might show to be necessary for completing a sanitary training.

The students who attend these various courses would have access to our valuable and indeed unique sanitary library, as well as to our Museum.

It has been our custom at the Parkes Museum to give general lectures open to the public during the session on all the principal hygienic questions. This we propose to continue and to extend; the programme of lectures for the winter session is already published. We propose further to avail ourselves of an opportunity which the Charity Commissioners have recently offered to the Institute for delivering similar lectures in the Institutions towards whose funds the Commissioners are about to contribute in various parts of London.

We trust also to organise sessional meetings, in order to give facilities to members and others to bring forward for discussion subjects relating to Hygiene which it is undesirable to hold over until the annual Congresses.

In pursuance of the main object of our Society, which is, by educating the public, to raise the standard of sanitary knowledge in this country, we propose to continue the arrangement originally adopted by the Sanitary Institute of Great Britain of holding Congresses from time to time in some important centre of population.

These Congresses have hitherto been eminently successful. Amongst the towns at which they have been held may be mentioned Exeter, Newcastle-on-Tyne, Glasgow, Dublin, Leicester, York, and Bolton. They have in each case brought together into personal relation with each other the Medical Officers of Health, Surveyors, and others connected with sanitation from all surrounding districts, as well as from distant parts of the country, and have thus been fruitful of most valuable discussions, paving the way for sanitary progress.

These Congresses have in each case been accompanied by Exhibitions of Sanitary Appliances, where the newest improvements in sanitary matters have been brought forward.

The Institute inaugurated a most careful system of judging the exhibits, by giving stability to its court of Judges; that is to say, whilst necessarily some change in the personnel of its judges goes on, yet the larger number of judges remain from year to year, so that there has been a uniformity in the principle upon which the awards have been based. An essential feature in judging articles for award, is the practical testing of those exhibits whose merit cannot otherwise be determined.

In connection with this matter of testing, it may be interesting to mention here that the Sanitary Institute of Great

Britain has on occasion appointed Special Committees, and advanced money, to enable tests to be made, apart from the exhibits, on some definite subject of interest which may have arisen. For instance, at the present time there is a committee which is making an exhaustive series of tests on all the various forms of cowls in use for chimneys and ventilating flues. The work of this committee has extended over some years. The enquiry has recently been completed, and the results are being prepared for publication. It has cost several hundreds of pounds. The money has been provided partly from the funds of the Sanitary Institute of Great Britain, but pincipally by contributions from individuals.

The Exhibitions form a valuable adjunct to the Parkes Museum. The Exhibitions bring forward what is new in sanitation; the Judges award prizes to what is good. The practice has been to make a careful selection from the exhibits to be annually added to the permanent Museum of the Institute, replacing the older forms, with the object of giving those visiting the Museum an opportunity of studying the new forms of apparatus and appliances which are being introduced in different parts of the country, but are not necessarily placed on the London market.

The awards made at the Exhibition, after careful testing, are intended in future to be recorded in the Museum, in order to afford the public a formal expression of the opinion of the Institute on the various appliances exhibited.

In the Museum all the exhibits will eventually be arranged, as far as possible, to demonstrate their practical working; and we propose to have in connection with the Museum testing rooms, and testing appliances of various kinds, for testing and experimenting on the sanitary apparatus. Moreover, inasmuch as an exhibition of details may sometimes be misleading, unless accompanied by the teaching of the principles upon which the details are founded, one of the main objects which we had in view in establishing the Museum as a means of education will not be complete until we have organised in connection therewith special demonstrations to explain to members and others the sanitary principles which underlie the construction of the articles selected for exhibition, as well as those principles which have guided the selection of the specimens of food, clothing, and other subsidiary matters.

We have held special Exhibitions, of limited extent, in the Museum from time to time. One, for instance, was an Exhibition of Domestic Gas Appliances, including gas fires, cooking stoves, ovens, coffee roasters, and water heaters, as well as washing and drying machines, &c., &c. This Exhibition was

accompanied by lectures upon cooking. Exhibitions of this sort entail but little expense on the exhibitors, and might be usefully extended if space admitted of it.

The Sanitary Institute of Great Britain published its first volume of Transactions in 1880, and has continued the publication annually since that time. These volumes have been edited with great care, and contain a large amount of valuable matter. The Parkes Museum has published from time to time some of the more important lectures delivered there. The new Institute proposes to publish its Transactions annually, so as to continue the valuable series commenced by the old Society.

The Sanitary Institute of Great Britain moreover published, at its own expense, two very important standard Sanitary works. One was the "Selections from the Reports and Writings of Dr. Farr on Vital Statistics," under the editorship of Mr. Noel Humphreys, which is the best existing text book on that science. The other is "Public Health Reports" of Sir John Simon, K.C.B., another highly distinguished pioneer in Sanitary Science and Preventive Medicine. This was edited by Dr. Edwd. Seaton. Both these works were undertaken by the Institute with the object of rendering accessible writings which were distributed through a mass of Blue Books and Reports, many of which are out of print, and which, until reproduced in a condensed form, were necessarily beyond the reach of students.

The new Institute hopes to continue the plan of assisting in the issue from time to time, as occasion may arise, of standard works on sanitation.

The Council hope further to develop the usefulness of the Institute by making the Museum a centre, where facts relating to recent progress in sanitation will be recorded, and available for the information of persons anxious to learn the newest recognized improvements, and in conjunction with its library and reading room, to make the Institute as it were, a house of call for persons connected with sanitation who come up to London from the provinces.

I have thus endeavoured briefly to lay before you a summary of the work which we trust that the Sanitary Institute in its new form will be able to organize and accomplish.

But in order to carry it into effect on a due scale, we shall require larger accommodation and better appliances than the Museum on its present site will admit of being provided. We especially want a curator whose whole attention can be directed to the Museum.

For these purposes we therefore require larger funds than we have hitherto had at command.

In their early careers the two separate Societies have each

had great difficulties to contend with; but in spite of those difficulties, they have achieved a distinct measure of practical results.

They point to these results as an evidence that the founders of the combined Society possess the knowledge, the capacity, and the will which are necessary for carrying on the further development of the Institute as a means of Sanitary education, and I trust that we may obtain such a measure of public support that our desire to supply what is undoubtedly a great public want may be realized.

THE SANITARY INSTITUTE.

Parkes Museum, 74a, Margaret Street, W.

REPORT OF THE COUNCIL,

Read at the FIRST ORDINARY GENERAL MEETING,

NOVEMBER 22nd, 1888.

In presenting the First Report to the Fellows and Members, the Council record with much pleasure the successful commencement of the Institute.

The Society was duly incorporated and registered on the 17th of August, 1888, and nearly 500 Members and Associates who were previously connected with the Sanitary Institute of Great Britain or the Parkes Museum, have joined the Institute.

In the Memorandum and Articles of Association, a large field of useful work is marked out for the Institute. It is proposed to hold Examinations, and grant Certificates of competency in Sanitary Knowledge; to maintain the Parkes Museum of Hygiene, and its valuable Sanitary Library; to establish Laboratories and Lecture Rooms in connection therewith; to institute courses of Lectures and Demonstrations; to hold Congresses in Provincial Towns for the discussion of subjects relating to Hygiene; to hold exhibitions of Sanitary objects and appliances, to test various exhibits, to award Medals and Certificates of Merit; to issue Transactions, and also to publish books or memoirs relating to Sanitary Science.

The Institute has had the honor of enrolling amongst its Members, H.R.H. The Duchess of Albany, H.R.H. The Duke of Cambridge, His Grace the Duke of Northumberland, His Grace the Duke of Westminster, The Earl of Derby, Earl Fortescue, Viscount Cranbrook, The Bishop of London, and many other influential persons.

H.R.H. The Duchess of Albany has graciously consented to accept the position of Patroness of the Institute.

The Council have nominated the following noblemen and gentlemen for election to-day.

President—The Duke of Northumberland.

Vice-Presidents—The Duke of Westminster.
Earl Derby.
Earl Fortescue.
Mr. Edwin Chadwick.
Sir Robert Rawlinson.
Mr. T. Twining.

Treasurer—Inspector-General R. Lawson.

The first Examination of the Institute was held on November 8th and 9th: 74 Candidates presented themselves, 15 as Surveyors, and 59 as Inspectors of Nuisances, being a larger number of Surveyors than ever presented themselves at any Examination of the old Society.

A programme of Lectures for the winter Session has been arranged.

The Council congratulate the members upon the success which has attended the commencement of the Institute, and they feel convinced that it will become a powerful means of promoting Sanitary Progress throughout the Country.

DOUGLAS GALTON,

Chairman of Council.

E. White Wallis, *Secretary.*
22nd Nov., 1888.

REPORT OF THE COUNCIL,

Read at the ORDINARY GENERAL MEETING,

NOVEMBER 27th, 1889.

In presenting their second Report to the Fellows and Members, the Council are glad to state that a considerable number of the objects set out in the Memorandum of Association have already been carried out by the Institute. The Institute itself has obtained a large measure of support, and the utility of its work has been recognised by the Crown Agents for the Colonies, the Charity Commissioners, Municipal Corporations, and other important public bodies.

Although some branches of the work of the Institute were referred to in the short Report made at the Ordinary General Meeting in 1888, the Council think it desirable to record in this Report the chief work done since the Incorporation of the Institute, including matters carried on partly under the auspices of the old societies but adopted by the new Institute.

During the year three Examinations have been held; one in November and one in May, of persons desirous of qualifying for the appointment of Inspector of Nuisances, and one in July of persons desirous of qualifying for the appointment of Local Surveyor.

In November fifty-nine Candidates presented themselves, the Examination extended over two days, being partly written and partly oral, and thirty-one Candidates were certified to be competent, as regards their sanitary knowledge, to discharge the duties of Inspector of Nuisances. In May seventy-six Candidates presented themselves, of whom thirty-eight were certified to be competent, as regards their sanitary knowledge, to discharge the duties of Inspector of Nuisances.

In July nine Candidates presented themselves, of whom five were

certified to be competent, as regards their sanitary knowledge, to discharge the duties of Local Surveyor.

Since these Examinations were first established 26 Examinations have been held, and 718 Candidates have been examined, of whom 62 have passed the Examination for Local Surveyors, and 385 that for Inspectors of Nuisances.

The Council believe that there are many persons who would be glad to avail themselves of these Examinations who are unable to come to London for the purpose; they have therefore arranged to hold Examinations in some of the chief towns of England. The first of these is arranged to be held in Manchester on December 20th and 21st next.

During the year two Courses of Lectures and Demonstrations for Sanitary Officers were held. These Courses are specially adapted for Candidates preparing for the Institute's Examinations for Inspectors of Nuisances. The first Course, held in October and November, 1888, comprised the following Lectures :—

Introductory Lecture. "General History, Principles, and Methods of Hygiene." George Vivian Poore, M.D., F.R.C.P.

"Drainage and Construction." Prof. H. Robinson, M.INST.C.E.

"Water Supply, Drinking Water, Pollution of Water." Louis Parkes, M.D., D.P.H. (LOND.)

"Ventilation, Measurement of Cubic Space," &c. Sir Douglas Galton, K.C.B., D.C.L., LL.D., F.R.S.

"Sanitary Appliances." Prof. W. H. Corfield, M.A., M.D. (OXON.)

"Scavenging, Disposal of Refuse and Sewage." H. Percy Boulnois, M.INST.C.E.

"Food (including Milk), Sale of Food and Drugs Act." Charles E. Cassal, F.C.S., F.I.C.

"Infectious Diseases and Methods of Disinfection." Shirley F. Murphy, M.R.C.S.

"General Powers and Duties of Inspectors of Nuisances.—Method of Inspection." J. F. J. Sykes, M.B., B.SC., D.P.H.

"Nature of Nuisances, including Nuisances the abatement of which is difficult." J. F. J. Sykes, M.B., B.SC., D.P.H.

"Sanitary Law.—General Enactments, Public Health Act, 1875, Model Bye-Laws." Dr. Charles Kelly, F.R.C.P.

"Sanitary Laws and Regulations Governing the Metropolis."

A. Wynter Blyth, m.r.c.s., Medical Officer of Health for St. Marylebone.

The second Course was held in March and April, 1889, when Lectures under similar titles were given by Benjamin Ward Richardson, m.d., ll.d., f.r.s.; Louis Parkes, m.d., d.p.h. (lond.); Sir Douglas Galton, k.c.b., d.c.l., ll.d., f.r.s.; Prof. H. Robinson, m.inst.c.e.; H. Percy Boulnois, m.inst.c.e.; Prof. W. H. Corfield, m.a., m.d. (oxon.); Charles E. Cassal, f.c.s., f.i.c.; Shirley F. Murphy, m.r.c.s.; J. F. J. Sykes, m.b., b.sc., d.p.h.; A. Wynter Blyth, m.r.c.s.

The preparation and delivery of these Lectures have entailed a large amount of labour on those who have so kindly come forward, time after time, to help in the work; and the Council desire to record their sincere thanks to them for the great benefits they have conferred upon the students.

The Council having understood that the Government proposed to introduce a measure for consolidating the Public Health Acts, and that one of its provisions was a requirement that all Inspectors of Nuisances should hold a Certificate of Competency, presented a memorial to the President of the Local Government Board, setting out what had already been done by the Examinations of the Sanitary Institute, and urging the desirability of these Examinations and Certificates being recognised in this proposed measure. The Council were informed by the President of the Local Government Board that the matter should receive consideration.

Early in the year a deputation from the Association of Public Sanitary Inspectors waited upon the Council, and urged the desirability of certain modifications in the Examination for Inspectors. The chief points in the suggested modifications were:—(1) That no Candidate should enter for Examination unless, by previous occupation and experience, he is fitted to discharge the duties of an Inspector of Nuisances; (2) That there should be two grades of Inspectors' Certificates; and (3) That building construction should be added to the Syllabus of Examination.

These subjects and others connected with the Examinations are of the greatest importance, and the Council have therefore referred the whole question of the Examinations to a Special Committee, in order to consider it in all its bearings. The difficulty of dealing with the sub-

ject is enhanced by the indefinite manner in which the duties and responsibilities of Officers are expressed in Sanitary Acts of Parliament.

The Course of General Lectures given during the Winter Session included the following subjects :—

"The Future of the Amalgamated Societies, the Parkes Museum and Sanitary Institute of Great Britain." Sir DOUGLAS GALTON, K.C.B., D.C.L., LL.D., F.R.S.

"The new Local Government Bill and the County Councils, especially in relation to Sanitary Administration." ERNEST HART.

"London, Ancient and Modern, from a Sanitary point of view." G. V. POORE, M.D.

"The Worm Parasites of Human Food." Prof. F. JEFFREY BELL.

"Notification of Infectious Diseases." B. A. WHITELEGGE, M.D.

"The Metropolitan Sewage Question." Col. W. HOPE, V.C.

"Fungi in their relation to Putrefaction and Sanitation." Prof. GEORGE R. MILNE MURRAY.

"House Sanitation from a Householder's point of view." Prof. W. H. CORFIELD, M.A., M.D.

"The Bagshot Sands in relation to Health." ALFRED HAVILAND, M.R.C.S.E., late Lecturer at St. Thomas's Hospital.

"Rural Epidemics." BUSHELL ANNINGSON, M.D.

"Fires and Fire Escapes, and the Prevention and Arrest of Fires." H. E. DAVIS, late Chief Officer of Margate, Westgate, Broadstairs, and St. Peter's Fire Brigades.

The Council desire to record their thanks to the Lecturers for the service they have rendered in advancing the objects of the Institute.

A Course of Lectures to Ladies on Domestic Hygiene was held during Lent, and included the following subjects :—

"Child Culture." A. T. SCHOFIELD, M.D., M.R.C.S.

"The Chemistry of Dairy Produce." (Two Lectures.) A. WYNTER BLYTH, M.R.C.S., F.C.S., F.I.C.

"Chemistry of Cleaning." Prof. V. B. LEWES, F.C.S., F.I.C., &c.

"Bread." WILLIAM JAGO, F.C.S., F.I.C.

"Domestic Uses of Petroleum Products." BOVERTON REDWOOD, F.C.S., F.I.C.

The ladies attending were invited to write reports upon the Lectures, and Certificates for satisfactory reports were awarded to eight ladies.

Many of the Lectures were elaborately illustrated with experiments, diagrams, and specimens, and the Council wish to express their gratitude to the lecturers for the trouble taken by them.

In June and July a Course of Ten Lectures and Demonstrations was arranged, dealing with subjects connected with Hygiene of special interest to the medical profession. The following Lectures were given, and were open free to all members of the medical profession:—

"Some Considerations on Ocular Hygiene." R. BRUDENELL CARTER, F.R.C.S.

"On the Infectious Hospitals of London as a Defence against Epidemics." EDWARD SEATON, M.D., F.R.C.P.

"Vital Statistics." LOUIS PARKES, M.D., D.P.H. (LOND.)

"The Water we drink." R. W. PEREGRINE BIRCH, M.INST.C.E.

"House Sanitation." Prof. W. H. CORFIELD, M.A., M.D. (OXON.)

"Adulteration." CHAS. E. CASSAL, F.C.S., F.I.C.

"Medical Guidance in the Selection of Schools for Certain Children." CLEMENT DUKES, M.D. (LOND.), M.R.C.P. (LOND.)

"Warming, Lighting, and Ventilation." Sir DOUGLAS GALTON, K.C.B., D.C.L., LL.D., F.R.S.

"Meteorology in Relation to Health." G. J. SYMONS, F.R.S.

"Bacteria in Relation to Disease." Prof. E. M. CROOKSHANK.

In recording their thanks for all these valuable Courses of Lectures, the Council would point out that the lecturers have given their services gratuitously, and without any expense to the Institute for diagrams or apparatus.

The Congress was held in the city of Worcester in September, 1889, under the Presidency of Mr. G. W. Hastings, M.P., and The Right Hon. Earl Beauchamp, the Lord Lieutenant of the County, accepted the office of Patron of the Congress. The reception given to the Institute was very cordial; there were present about 100 Members and Associates of the Institute, 178 holders of Congress tickets, and about 50 invited guests, including representatives from sanitary authorities in several important towns.

The subjects brought forward in the various sections were of considerable importance and interest; a full report of the papers read and the discussions upon them will appear in the Transactions of the Institute for 1889.

The Conference of Medical Officers of Health has now become a very important feature of the Congress. This year the country meeting of the Society of Medical Officers of Health was held in Worcester at the same time as the Meeting of the Sanitary Institute, and the organisation of the Conference was jointly undertaken by the Institute and the Society; subjects of considerable interest were brought forward and discussed by well-known and representative medical officers, and the Conference was well attended. This Conference has afforded an example of the utility of providing an opportunity for those engaged in sanitary work all over the country to meet and discuss matters in which they are severally interested, and has led to a proposal that a Conference for Sanitary Inspectors should be arranged in future Congresses. The Council will take the matter into early consideration.

The Exhibition was open 23 days, and was visited by about 23,000 persons. There were 108 Exhibitors. The Judges awarded 17 Medals and 46 Certificates; 73 exhibits were selected for further practical trial and testing. The results of these trials will be reported at a special meeting in the spring, when the Medals and Certificates will be presented.

A Special Committee has been appointed to consider Bills relating to Sanitary matters introduced into Parliament, and on their recommendation the Council decided to take the following action with regard to Bills introduced last session: to petition against the Sanitary Registration of Buildings Bill; to petition in favour of the Diseases Notification Bill, and of the Poor-Law Bill. The Sanitary Registration of Buildings Bill did not reach the second reading, but the other two have become law.

The important question of Smoke Abatement has been several times under the consideration of the Council. At the Exhibitions of the Institute a special Section is devoted to apparatus designed to promote this object. The Council have appointed a Special Committee to consider in what way the Institute can best take action to promote the abatement of smoke, which so largely affects the health and well-being of the community.

Early in the present year H.R.H. The Duchess of Albany graciously consented to become Patroness of the Institute.

It is with much regret that the Council have to report the deaths

of James Howard, Fellow, of the Right Hon. Lord Mount Temple, Dr. S. O. Habershon, William Parkes, and Dr. J. W. Sanders, Ordinary Members, and of R. C. Chappell, Associate; two Members have retired.

Since the incorporation of the Institute in August, 1888, 554 Members and Associates from the Sanitary Institute of Great Britain, and from the Parkes Museum have been enrolled, and 96 Ordinary Members and 104 Associates have been elected. The registers of the Institute contained, on September 30th, 116 Fellows, 421 Ordinary Members and 207 Associates, making a total of 744.

The Council are glad to record this large and rapid increase during the year of nearly 200 Members and Associates, as evidence of the appreciation of the work done by the Institute.

Several interesting exhibits have been added to the Museum during the year, including a Health Cabinet for the purpose of demonstration at Lectures. About 8500 persons visited the Museum.

Owing to want of funds, the Council have not yet been able to complete the catalogue and classified index of the Museum which they have long had in view and much at heart. They trust that the increased support which the Institute is receiving, will enable them to proceed with the matter during the ensuing year.

The Library is now much used by Students attending the Lectures. Since August, 1888, about 750 volumes and pamphlets have been added, and the general Catalogue is now nearly complete.

The Examiners of the Royal College of Physicians, of the Royal College of Surgeons, and of the University of London, have made use of the Museum for the purpose of the practical portion of their Examinations for the Degree or Diploma in Sanitary Science. The Maria Grey Training College, the Home and Colonial College, Professor Corfield, Mr. Fairchild, Dr. Kelly, Dr. Louis Parkes, Mr. Pope, Mr. Walter Pye, Dr. E. Seaton, Dr. Turner, and Dr. Walters, have also on several occasions made use of the Museum for the purpose of giving practical demonstrations to their classes.

The Council have been urged to take steps towards a Federation of the various Sanitary Societies, and in response to a deputation from the Manchester and Salford Sanitary Association, which waited on them at the Worcester Congress, they have agreed to draft a scheme and bring it under the consideration of the principal

Societies interested. The Council believe that, if satisfactory arrangements can be made, a Federation of this kind will be productive of much good in strengthening and consolidating sanitary effort.

In accordance with the Articles of Association the Council have prepared a code of By-Laws, which has been issued to the Members and Associates.

The financial statements appended to the Report show the assets and liabilities taken over from the old societies, and also the cash receipts and payments up to September 30th, 1889. As the financial year does not close until December 31st, this latter statement does not include assets and liabilities, and in no way shows the financial position of the Institute at the present time.

The Council, therefore, propose to make out a complete statement upon the close of the financial year and to issue it to the Members.

DOUGLAS GALTON,

Chairman of Council.

E. White Wallis, *Secretary.*

27th Nov., 1889.

Statement shewing Liabilities & Assets taken over by THE SANITARY INSTITUTE, covering the period to end of the year 1888.

LIABILITIES.	£ s. d.	£ s. d.
Sundry Creditors—		
Watson Bros., Builders—account for alterations in Museum in progress ..	92 17 10	
Less Discount	7 17 10	
		85 0 0
Soper, A.—Arrangement of Library...		10 0 0
Eyre & Spottiswoode, Printers		213 18 9
Kenny & Co. „		295 6 3
Boot & Son „		56 10 11
Thompson (Evans & Co.) „		3 0 0
Noel Humphrey		2 5 0
MacDowell—Rent to Christmas.........		48 10 10
E. White Wallis, Salary to Christmas.		68 15 0
Wages (Increase to December, 1888)...		8 9 0
Petty Cash Disbursements to Dec., '88		57 5 4
Gas to Christmas		9 15 4
Examination Fees and Expenses in Suspense		136 0 9
Broadbent		10 8 4
Amalgamation and Incorporation Expenses		253 9 5
To Balance of Assets over Liabilities at this Date..................................		1808 6 8
		£3067 1 7

ASSETS.	£ s. d.	£ s. d.
Lease of Premises, Margaret Street—		
12 years unexpired to July, 1900		595 16 8
Library and Contents of Museum—		
Estimated Value		500 0 0
Furniture and Fixtures—		
Estimated Value		100 0 0
Transactions and Publications—		
727 Transactions, bound, at 4s.	145 8 0	
1754 „ unbound, at 3s. 6d...	306 19 0	
Advertisements, Balance owing.........	42 13 0	
		495 0 0
Farr's Works—		
168 Copies, bound, at 7s. 6d.	63 0 0	
Subscriptions due, £14 14s., valued, *vide* list in old books	2 11 0	
		65 11 0
Simons' Works—		
70 Copies, bound, at 10s..................	35 0 0	
196 „ unbound, at 7s. 6d.	73 10 0	
Subscriptions due, £28 4s,, valued at	14 14 4	
		123 4 4
Subscriptions in arrear—		
Parkes Museum, as per old books, valued at..................................		10 10 0
Sanitary Institute of Great Britain, as per old books, valued at...........		30 9 0
Cash at Bankers—		
Union Bank, Parkes Museum account	867 7 5	
Drummond's Bank, S.I.G.B. „	279 3 2	
		1146 10 7
		£3067 1 7

Examined and approved,

ALFRED LASS,
MAGNUS OHREN, } *Auditors.*

18*th November*, 1889.

THE SANITARY INSTITUTE.

Abstract of Cash Receipts and Payments from October 1st, 1888, to September 30th, 1889.

To	£	s.	d.	£	s.	d.
Cash received on account of the Assets transferred from the old Societies, viz.,						
Balance of Banking Accounts	1146	10	7			
Arrears of Subscriptions, &c.	52	10	4			
Sundry Accounts for Advertisements, &c.	42	13	0			
				1241	13	11
Cash received on account of the Current year's income, viz.—						
Entrance Fees	39	18	0			
Life Compositions	52	10	0			
Subscriptions	407	19	6			
Donations	4	14	6			
Sale of Publications	16	14	4			
Sale of Farr's Works	13	6	7			
Sale of Simons' Works	6	12	3			
Lectures, &c.	47	15	4			
Examination Fees, &c.	171	16	8			
Congress	21	10	6			
Exhibition (Worcester)	550	16	0			
				1333	13	8
Subscriptions paid in advance (1890)				1	1	0
Temporary Loan				150	0	0
				£2726	8	7

By	£	s.	d.	£	s.	d.
Cash paid on account of the Liabilities transferred from the Old Societies, viz.,						
Sundry Accounts				1108	18	1
Cash paid on account of the current year's expenditure, viz.,						
Rent	126	13	0			
Salaries and Wages	313	0	0			
Printing, Postage, and Incidental Expenses	114	5	10			
Lectures, &c.	68	9	10			
Examinations	117	1	4			
Congress	41	2	9			
Exhibition (Worcester)	392	16	0			
Office Furniture	6	9	10			
				1179	18	7
Balance in hand—						
At Bank	136	12	11			
,, (Exhibition Account)	280	13	9			
Petty Cash	20	5	3			
				437	11	11
				£2726	8	7

Examined and approved,

ALFRED LASS,
MAGNUS OHREN, } *Auditors.*

18*th November*, 1889.

REPORT OF THE COUNCIL,

Read at the ORDINARY GENERAL MEETING,

MARCH 25th, 1890.

From the completion of the period covered by the last Annual Report, but a short time remained to the end of the year 1889; there is therefore little for the Council to record in the present Report.

Two Examinations have been held—one in November in London, and one in December in Manchester; both for Inspectors of Nuisances. In November sixty-nine Candidates presented themselves, and thirty-nine were certified to be competent as regards their sanitary knowledge to discharge the duties of Inspector of Nuisances. In December twenty Candidates presented themselves, and twelve were certified to be competent as regards their sanitary knowledge to discharge the duties of Inspector of Nuisances.

This Examination at Manchester is the first that the Institute has held out of London, and it was arranged on rather short notice; but the result shows that it was useful in making the Examinations of the Institute available to those who could not conveniently come to London for the purpose. The Council have now under consideration the arrangement of an Examination at Bristol at the end of June, and a number of applications have already been sent in by Candidates.

Since the Examinations were first established, Twenty-eight Examinations have been held, and eight hundred and seven Candidates have been examined, of whom sixty-two have passed the Examination for Local Surveyors and four hundred and thirty-six that for Inspector of Nuisances.

A course of lectures and demonstrations for sanitary officers was held in October and November, 1889. The course is especially

adapted for candidates preparing for the Institute's Examinations for Inspector of Nuisances, and comprised the following lectures :—

Introductory Lecture. "General History, Principles, and Methods of Hygiene." Sir EDWIN CHADWICK, K.C.B.

"Water Supply, Drinking Water, Pollution of Water." Dr. LOUIS PARKES, D.P.H. (LOND.)

"Drainage and Construction." Prof. H. ROBINSON, M.INST.C.E.

"Ventilation, Measurement of Cubic Space, &c." Sir DOUGLAS GALTON, K.C.B., D.C.L., LL.D., F.R.S.

"Sanitary Appliances." Prof. W. H. CORFIELD, M.A., M.D. (OXON.)

"Scavenging, Disposal of Refuse and Sewage." H. PERCY BOULNOIS, M.INST.C.E.

"Food (including Milk), Sale of Food and Drugs Act." CHARLES E. CASSAL, F.C.S., F.I.C.

"Infectious Diseases and Methods of Disinfection." SHIRLEY F. MURPHY, M.R.C.S.

"General Powers and Duties of Inspectors of Nuisances; Method of Inspection." J. F. J. SYKES, M.B., B.SC., D.P.H.

"Nature of Nuisances, including Nuisances the Abatement of which is Difficult." J. F. J. SYKES, M.B., B.SC., D.P.H.

"Sanitary Law. General Enactments, Public Health Act, 1875, Model Bye Laws." A. WYNTER BLYTH, M.R.C.S.

"Sanitary Laws and Regulations Governing the Metropolis." A. WYNTER BLYTH, M.R.C.S.

The Council desire to record their sincere thanks to the lecturers for the great benefits they have conferred upon the students.

The numbers attending these lectures show a considerable increase.

A desire having been expressed for discussions upon sanitary subjects, which were hardly in place after general lectures, the Council arranged for Sessional Meetings during the winter and spring. The first was held on December 11th, when a paper was read upon "The Disposal of Sewage," by W. Santo Crimp, ASSOC.M.INST.C.E. The paper was followed by a discussion.

It is with much regret that the Council have to report the deaths of H. R. Newton and W. H. Weddell, Members. Four Members have retired. Since Sept. 30th 18 Fellows, 20 Members, and 6 Associates have been elected. The Registers of the Institute con-

tained on December 31st, 134 Fellows, 416 Ordinary Members, and 211 Associates, making a total of 761.

The Library is in continual use by students attending lectures and others. About 70 volumes and pamphlets have been presented since September last.

The examiners of the Royal College of Physicians and of the Royal College of Surgeons have made use of the Museum for the practical portion of their examination for the Diploma of Public Health, and teachers of hygiene have on several occasions brought students to the Museum for the purpose of giving demonstrations.

The Council append to this Report a complete statement of the Income and Expenditure for the year ending December 31st, 1889, and also statement of Assets and Liabilities at the close of that year.

With reference to these statements, they would remark that the deficiency on the year of £602 3s. 2d., shown in the statement of Income and Expenditure, is made up of two items; one a cash deficiency of about £530, the other, a reduction of stock and depreciation of leasehold, amounting to about £72. The cash deficiency is primarily due to the large amount of work undertaken by the new Society since the amalgamation, and to the profits from the Exhibition at Worcester having been less than the average amount. The Council are making efforts to clear off this deficiency by donations, and have appointed a special Committee, to consider the whole question of the financial position of the Institute, and to advise the Council what will be the best steps to take, to make the expenditure and the income of the Institute balance in the future. Certain modifications in the working of the Institute have already been made towards accomplishing this object.

DOUGLAS GALTON.

Chairman of Council.

E. White Wallis, *Secretary.*

March 25th, 1890.

STATEMENT of INCOME and EXPENDITURE, for the Year ended 31st December, 1889.

Dr.

Expenditure.	£	s.	d.	£	s.	d.
To Transactions, Cost of Printing, &c., less Sales and Advertisements—estimated	303	13	4			
Sessional Meetings	5	0	8			
Lectures, General	40	1	8			
,, Sanitary Officers	23	8	2			
,, Domestic Hygiene	27	5	4			
,, Medical Men	8	4	0			
Examinations	306	18	4			
Congress, Worcester	234	8	7			
				949	0	1
Rent, Rates, and Taxes	241	6	2			
Salaries and Wages	513	8	0			
Coals and Care of Offices	44	17	9			
Repairs and Alterations	4	15	0			
Arrangement of Museum	14	5	6			
Library, Cataloguing, and Binding	36	7	2			
Office Furniture	6	9	10			
Postage and Carriage	47	10	7			
Printing and Stationery	125	11	3			
Advertising	13	0	6			
Incidental Expenses	42	6	9			
Auditors	10	10	0			
Law Charges	8	1	0			
Depreciation of Leasehold	49	13	0			
				1158	2	6
				£2107	2	7

Cr.

Income.	£	s.	d.	£	s.	d.	£	s.	d.
By Annual Subscriptions	483	1	0						
Ditto, Parkes Museum and S. I. G. B. additional	14	14	0						
				497	15	0			
Entrance Fees				74	11	0			
Life Compositions				63	0	0			
Fellowship Fees				95	0	0			
Donations				4	14	6			
							735	0	6
Museum—General Admissions				2	8	6			
Lectures— Admission Fees				2	17	3			
Do. Sanitary Officers do.				48	6	1			
Do. Domestic Hygiene do.				22	17	10			
Examinations				332	9	4			
Congress, Worcester				92	13	0			
Exhibition—Profit				245	8	9			
Simon's Works—Profit on Sales				1	17	6			
Farr's ,, ,, ,,				21	0	8			
							769	18	11
							1504	19	5
Deficiency on the Year carried down							602	3	2
							£2107	2	7

1889.		£	s.	d.
Dec. 31.	To Deficiency on the year brought down	602	3	2
	Balance to be carried forward	1206	3	6
		£1808	6	8

1889.		£	s.	d.
Jan. 1.	By Balance of Assets over Liabilities brought from last Account	1808	6	8
		£1808	6	8

Examined and approved,

Alfd. Lass & Co., Chartered Accountants,
Magnus Ohren, Assoc.M.Inst.C.E., } *Auditors.*

STATEMENT of INCOME and EXPENDITURE connected with Exhibition at Worcester, 1889.

Dr.

Expenditure.	£	s.	d.
To Printing and Advertising	224	4	2
Catalogue and Programmes	129	17	0
Band and Entertainments	108	17	6
Lectures and Working Dairy	71	8	6
Curator's Salary and Expenses	211	9	1
Wages	108	19	3
Incidental Expenses, Fittings, &c.	88	15	0
Judging Expenses	118	10	9
	1062	1	3
Balance profit	245	8	9
	£1307	10	0

Cr.

Income.	£	s.	d.
By Rent for Space, &c.	543	14	5
Admissions	547	18	11
Catalogues and Programmes, Sales and Advertisements	215	16	8
	£1307	10	0

Examined and approved,

Alfd. Lass & Co., Chartered Accountants, } *Auditors.*
Magnus Ohren, Assoc.M.Inst.C.E., }

GENERAL BALANCE SHEET, 31st DECEMBER, 1889.

Liabilities.	£	s.	d.
Sundry Creditors	875	0	8
Balance of Assets over Liabilities at this date	1206	3	6
	£2081	4	2

Assets.	£	s.	d.	£	s.	d.
Lease of Premises, Margaret Street, 11 years unexpired				546	3	8
Library and Contents of Museum, Estimated Value				500	0	0
Furniture and Fixtures, Estimated Value				100	0	0
Transactions and Publications	450	14	6			
Farr's Works	57	0	0			
Simon's Works	106	0	0			
				613	14	6
Sundry Debtors—						
Members' Subscriptions, 1889	54	12	0			
„ Arrears	24	3	0			
Fellowship Fees	42	10	0			
Entrance Fees	21	0	0			
Exhibition Accounts	13	0	0			
				155	5	0
Cash at Bankers				166	1	0
				£2081	4	2

Examined and approved,

Alfd. Lass & Co., Chartered Accountants,
Magnus Ohren, Assoc.M.Inst.C.E. } *Auditors.*

Congresses held by the Institute.

LEAMINGTON, 1877.

President.—B. W. RICHARDSON, M.D., LL.D., F.R.S.

Presidents of Sections.

Section I.—Edwin Chadwick, C.B.
„ II.—George Wilson, M.A., M.D., F.C.S.
„ III.—R. Brudenell Carter, F.R.C.S.

STAFFORD, 1878.

President.—EDWIN CHADWICK, C.B.

Presidents of Sections.

Section I.—B. W. Richardson, M.D., LL.D., F.R.S.
„ II.—Henry Day, M.D., F.R.C.S.

CROYDON, 1879.

President.—B. W. RICHARDSON, M.D., LL.D., F.R.S.

Presidents of Sections.

Section I.—Alfred Carpenter, M.D., M.R.C.P.Lond., C.S.S.Camb.
„ II.—Captain Douglas Galton, R.E., C.B., D.C.L., F.R.S.
„ III.—G. J. Symons, F.R.S.

EXETER, 1880.

President.—THE RIGHT HON. EARL FORTESCUE.

Presidents of Sections.

Section I.—Prof. de Chaumont, M.D., F.R.S.
„ II.—R. Rawlinson, C.E., C.B.
„ III.—Sir Antonio Brady.

NEWCASTLE-UPON-TYNE, 1882.

President.—CAPT. DOUGLAS GALTON, R.E., C.B., D.C.L., F.R.S.

Presidents of Sections.

Section I.—Denis Embleton, M.D., F.R.C.S.
„ II.—H. Law, M.Inst.C.E.
„ III.—Arthur Mitchell, M.A., M.D., LL.D., F.R.S.

GLASGOW, 1883.

President.—PROF. G. M. HUMPHRY, M.D., F.R.S.

Presidents of Sections.

Section I.—Prof. W. T. Gairdner, M.D., LL.D.
" II.—Prof. T. Roger Smith, F.R.I.B.A.
" III.—R. Angus Smith, Ph.D., F.C.S.

DUBLIN, 1884.

President.—SIR ROBERT RAWLINSON, C.B.

Presidents of Sections.

Section I.—T. W. Grimshaw, M.A., M.D.
" II.—C. P. Cotton, M.Inst.C.E.
" III.—Charles A. Cameron, F.R.C.S.I.

LEICESTER, 1885.

President.—PROF. F. DE CHAUMONT, M.D., F.R.S.

Presidents of Sections.

Section I.—Arthur Ransome, M.A., M.D., L.S.A., F.R.S.
" II.—Percival Gordon Smith, F.R.I.B.A.
" III.—William Marcet, M.D., F.R.Met.Soc., F.C.S., F.R.S.

YORK, 1886.

President.—SIR SPENCER WELLS, Bart.

Presidents of Sections.

Section I.—Prof. F. de Chaumont, M.D., F.R.S.
" II.—Baldwin Latham, M.Inst.C.E., F.R.Met.Soc.
" III.—William Whitaker, B.A.. F.G.S.

BOLTON, 1887.

President.—RIGHT HON. LORD BASING, F.R.S.

Presidents of Sections.

Section I.—Prof. J. Russell Reynolds, M.D., F.R.S.
" II.—Prof. T. Hayter Lewis, F.S.A., F.R.I.B.A.
" III.—Prof. A. Dupré, PH.D., F.I.C., F.C.S., F.R.S.
Conference of M.O.H.—Prof. W. H. Corfield, M.A., M.D.

WORCESTER, 1889.

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SERMON

PREACHED BY CANON CREIGHTON,

IN

WORCESTER CATHEDRAL,

Sunday, September 22nd, 1889.

PSALM CXXVII. 2.

"Except the Lord keep the city the watchman waketh but in vain."

It is in no spirit of mere complimentary speech, but with a deep sense of reality and earnestness, that I say there is no occasion that could more strikingly bring before our minds all the greatness of England's past and all the hopes of England's future than the occasion on which we meet to-day. I see before me the representatives of all that have made England great in the past, of all that constitute the strength of our national life in the present. In you, Mr. Mayor, and the members of the Town Council I see the symbols of that spirit of local self-government upon which the freedom of England has always rested; I see the symbols of those qualities which have made our country great, and which still distinguish it from other countries in Europe and at large. For the spirit of local self-government, the capacity for the management of our own affairs, is the special characteristic of Englishmen, the distinguishing inheritance of our past. It is an inheritance which our own day has increased, which daily becomes more precious to us, which we hope takes deeper root, and will spread still further in the future. And that power of local self-government—what moral qualities does it entail, not only on those who bear office, but on those who submit to their rule, not only upon the rulers, but upon the people whose representatives those rulers are? It is amazing, it is gratifying, when we think of the amount of civic patriotism which every great English city can display, the amount of self-devotion to public interests, the willingness to sacrifice time and money, to give of your best to the good of the community of which you form part. It is a great symbol of, and a great testimony to, the unity of our English life and the way in which we are striving onwards and upwards to find out a path towards better things. We have reason to be proud of our local institutions; we have reason to rejoice in the feelings of civic patriotism. Woe betide us if we let them go, woe betide us if the love of

self-government, which is the foundation of our freedom, does not beat high in the heart of every Englishman.

And yet you will observe that that sense of local patriotism, of which we are so proud, does not stop short at the boundaries of our domains. We have no exclusive civic pride. We do not rejoice that we are greater or better than other places. We are content to feel that we are citizens of no mean city. We are content to have the spirit of a dignified Corporate life displayed amongst us. We are content to go upon our way without jealousy, without rivalry, without wishing to put ourselves forward, merely striving that we may be worthy of the vocation whereunto we are called. Our local patriotism is strong and vigorous; but it does not separate us from the great current of the national life. No! rather it leads us more distinctly and decidedly to flow strongly into that great stream, and to pour our energies into its mighty waters. We are reminded of that fact to-day by the presence here of my brethren, the Volunteers. They show the contribution which this city willingly makes towards bearing its share of the national burdens. It is again a characteristic of England that it does not lay burdens upon unwilling shoulders. England can count upon the willing offering of the time, the labour, the patience, the endurance of a sufficient number of its citizens to provide for the work of the national defence. Again, England rests upon a basis of true freedom; English life is laid upon the firm foundations of duty; England appeals to its citizens, and England knows that this appeal will be readily listened to.

Yet another thought, characteristic of the best side of English life, is suggested by the special circumstances under which we are met to-day. We are proud as a city to welcome guests within our walls; we are proud as a city to think that we shall be the seat for a short time of the deliberations of those who are engaged in striving to direct the national attention to objects of great and serious national concern; and we welcome the Sanitary Institute. We welcome them that we may listen to the teaching which they bring us; that we may learn those lessons of which we all stand in need. It is another characteristic of English life that we are progressing, that we desire to go onwards, not resting satisfied with the achievements of the past, but with a deep sense of the problems which we have to face in the present, and of the difficulties which we have to overcome in the future. Convinced of this, we welcome all teaching we can receive. We ask that we may be shown how we may discharge our duties better. We beg that the seriousness of our responsibilities may be brought home to our minds. We do not refuse to undertake great tasks or to face onerous obligations. We only ask that

we may be convinced, assured; that we may see our duty clearly; and then, in all humility, we are ready to accept the accompanying obligation.

How important is the subject that is to be brought before our attention this week I perhaps need hardly say; but here in this place there are one or two considerations which I will lay before you—considerations bearing on the religious duty, and the religious spirit, with which we ought to enter upon our hearing, or our teaching, in the week that begins to-day.

The question of the organization of common life is one which increasingly comes home to us. More and more does it become an object of general concern that common life should be organized well, that it should be organized in a healthy way, so that every human being should have his due share of the great gifts which God bestows upon all men. But we have to admit that the rapid development of modern days—all that we proudly speak of as progress, civilization, and the advance of industry—all this has done much to deprive the great masses of Englishmen of many blessings which they enjoyed in simpler times. I take it that it is the highest glory of the Sanitary Institute to recognise this grievance and try to remove it. It tells us that modern progress has been bought at a heavy price. It has done ill as well as good; it owes a compensation for the evils which it has wrought. Industry and commerce sacrifice many victims to their progress. It is for us to do our best that the sacrifice should not be excessive, that the good of the few should not be procured at the sacrifice of the many. We have to consider in what way we can make compensation for the evils which our industrial system unavoidably inflicts upon a great number of our population.

God made the world and took pleasure therein. God spread a covering of free pure air which all admit men could enjoy. Aye, but modern industry, remember, has poisoned that clear air of God, has filled it with fumes pestilential and detrimental to the health of many who are compelled to live within their reach. God made the water to trickle from many fountains, and gather in many streamlets, that flow into the rivers. God sent it forth pure and clear, a refreshment unto man. Modern industry has polluted the sources of our streams, has filled them with noxious products, has rendered them turbid and discoloured, no longer a joy unto the eye, no longer fitted to supply man's needs. Modern industry has drawn men to live together in masses in which they never lived before; and by bringing men together in masses has brought about conditions of common life which are in many case hurtful to health, and in all cases tend to rob life of its simple and natural pleasures.

This is the subject which you have undertaken to consider, which is of universal concern—how these wrongs may be remedied, how clear air may again carry health into the lungs, how our water may again be made pure, and refreshing to the weary and the toiler, how the surroundings of life may be made decent, so that life itself may be made healthful, may be made pure. These are great questions. Surely they appeal to the natural justice of every man. Surely the organisation of our common life, so that every man can enjoy those great boons of nature which he was born to possess, is a question to which, as Christian men, we ought to turn our most serious attention.

But yet another thought—the progress of science. We speak of it, we are proud of it. The progress of science—have you thought of the responsibilities which the growth of knowledge brings to every man? The surer knowledge of the laws of Nature—what is it but a perpetual revelation of God's purposes to man? The contents of that revelation are assuredly binding on our consciences and form part of our duty as Christians. Whatever science shews us to be true it has a claim upon our attention and ought to influence our acting. Remember the answer of Jesus to the question, "Master, who did sin, this man or his parents, that he was born blind?" The answer came, "Neither did this man sin nor his parents, but that the works of God might be made manifest in him." The cause of affliction and ill-health is not to be found, as of old it was found, entirely in the sin or offence of the sufferer or his ancestors. Suffering and affliction is a manifestation of the works of God, and we recognise God's call to us as individuals when we have to face illness. All manifestations of God's works call for a corresponding effort on our part; and when science demonstrates the causes of ill-health, there is an addition to human knowledge, which involves a new responsibility both for our individual selves and for the common welfare. Every man has the right to live in such way that he can offer himself, with all his natural gifts and capacities, to God's service. Shall we offer unto God the maimed and the lame and the blind and the halt? Shall we not consider that it is our duty to see that all men should grow up in the enjoyment of health and strength and vigour, that thereby they may be the more able to serve God in their day and generation.

Oh! to pass along the street and see the pallid faces, the languid step! It is a reproach to us—these things ought not to be, for we know that they need not be. And if there come any among us who can teach us better how these things may be avoided, if there come any among us who, with wisdom and with forethought and with prudence, can put before us means

by which our common life may be improved, by which that precious gift of health can be increased and brought unto the humblest and the lowliest; then, dear friends, are we not bound to give them a hearty welcome, to listen to them, to value them highly for their work's sake, to submit ourselves to the message which they have to bring?

Again there is the analogy between the health of the body and the health of the soul which St. John recognised when he hoped that his friend "might prosper and be in health even as his soul prospered." It is hard for those who live with enfeebled frames amid neglected and filthy surroundings to feel strong aspirations after the beauty, the purity and the truth of a spiritual life. The other night I passed through one of the back streets of this city. It was at a time when the workmen left their work, and when the street was crowded with many men who were hastening, some to their homes, some to their pleasures. And as I passed by I saw one little group which consisted of three little girls of the age of four or five who had been placed by an elder girl upon a doorstep that was higher than the street. There they were, ranged in a row, their little hands were folded and their eyes were shut, and the elder girl, who stood below in the crowded street, was teaching them to lisp out the words of the Lord's Prayer. I thought that there in this crowded street was a symbol of the real operation of the work of God's Holy Spirit, that there was a lesson from which every casual bystander had much to learn, and then I thought of those fair young souls, like rosebuds opening in the garden of God—what would be their future? Would the seed thus sown take root and bear fruit? Would those buds blossom with all the beauty God could give, or would the canker worm destroy? Would they perish there amid the evil that gathered round them?

The conditions under which life is lived, the unwholesome air of the factory, the crowded room, the ill-ventilated chamber, all those things that rob the body of its vigour, how must they react upon the soul? You heard in the Epistle this morning of the works of the flesh—uncleanliness, hatred, variance, drunkenness, revelling. Do not these things, think you, come very largely from, and are they not greatly affected by, the physical conditions with which life is lived? If we allow health and strength to be slowly sapped by want of consideration of the actual physical conditions in which life is lived, surely we are responsible for bringing ruin to the young soul, for not doing our part to clear the weeds from the fair garden of God, so that every plant that is sown therein by the grace of His Holy Spirit may grow into all the beauty which the grace of God alone can give. Yes, there is much to be done. It is useless for us to fold our hands

and speak of past progress or present civilisation. The level of the past can only be maintained, and the progress of the future can only be assured, if we offer ourselves, hearts and souls, to God, and work our work in humble dependence on His will—It is as true now as it was in the days of old. It is useless that you raise your voices as guardians of the public health, unless God provides the attentive ear and the willing heart; for you ask both for prudence and unselfishness; you urge measures of precaution which are often opposed to self interest.

Our common life cannot be built upon a basis of self interest. No; our common life must be built upon the basis of self-sacrifice —self-sacrifice which God can bless. Our sacrifice must be brought to the altar of God that He may hallow it before we offer it to the service of our fellow men. That is the great reason of our meeting here to-day, that we may hallow to God all we have striven to do for the common good in the past, that we may ask God's blessing upon all our endeavours in the future. We have brought ourselves to Him that we may ask Him that He will now lift up our hearts, so that we may see and know what things we ought to do; that by the help of His Holy Spirit we may have that true judgment in all things whereby only the lessons of science and the teachings of wisdom can be made fruitful to the eternal good of man.

INAUGURAL ADDRESS

Delivered Sept. 24th, 1889,

By George Woodyatt Hastings, M.P., LL.M., D.L., J.P.,

PRESIDENT OF THE CONGRESS.

Ladies and Gentlemen of the Sanitary Institute,

It was, I assure you, with unfeigned reluctance that I consented, at the kind request of your Council, to accept the Presidency of your Congress; not from any want, as you may well believe, of sympathy with your objects or of admiration for your past efforts, but because I did feel how many there were much more competent than I can pretend to be to fill this position. To-night there are many here from whom I would gladly learn, there must be very few whom I could presume to teach. The great profession of medicine has, for instance, the highest claims to precedence on the subject of sanitary science. Sanitary engineers, again, can speak with an authority far beyond that of anyone who has not been trained in their profession, and sanitarians of all classes who have been able to devote their time to this great subject are entitled to be heard when others who have not had their advantages ought to be silent. There are, indeed, two respects in which I may venture to think that I may have some knowledge and some claim to be heard. The Social Science Association, to which my friend Sir Douglas Galton has alluded, dealt largely for many years with the great subject of public health. Its transactions are replete with information. They are a storehouse of knowledge on sanitary subjects, and it would be affectation in me to pretend that during my long connection with that Association I did not learn a good deal, at any rate in a theoretical point of view, in regard to

sanitary work. And again, during seven sessions of Parliament I have served on that Sessional Committee of the House of Commons, which goes by the name of the Police and Sanitary Committee of the House, to which committee are referred all bills dealing with sanitary questions, and of that committee I have now through three sessions had the honour to act as chairman. Naturally, during that period I have had a large number of sanitary questions brought before me, argued before me by some of the ablest counsel in the land, supported as to their details by expert witnesses of great knowledge, and I have learnt, necessarily, sitting with that committee, much of the detail of the work with which you in this Institute deal.

I therefore will venture, though with humility, to make a few observations to you this evening on some practical questions relating to sanitary administration in this country. But before I do so I ask to be permitted to express one great regret of mine concerning an absence this evening. I had hoped to have seen here one—I sent a special invitation to him,—one whom I must call the father of sanitary science in this country, Sir Edwin Chadwick. He had been most anxious to be present. He has written to me a most kind letter expressing his sympathy with this meeting and his undiminished desire for the improvement of public health; but at his patriarchal age, with the weight of 90 years upon him, it is not to be wondered at that he does not feel equal to the journey to Worcester and the return journey home. That, I believe, is the only reason for his absence.

Now, I would venture to point out that there are many influences on the state of public health in this country which, in dealing with this question, we ought to take into consideration, and it is the consideration of these influences on public health which, I think, will lead us to understand by what means public health can be best preserved. First, there is one great influence on the state of public health, and that is the influence of habitation, one, perhaps, much wider than we are usually in the habit of believing. I fancy that a very wide research into the various conditions of habitation would be necessary before we could arrive at any exact knowledge as to the causes of the fluctuations of public health in this country. We should have, for instance, to go into geological questions with regard to soil before we could solve all the problems. We should have to consider conditions of subsoil and many others which we are not usually in the habit of taking into account. It was only to-day that I heard an interesting fact bearing on this aspect of the question—that in the city of Salisbury, for instance, in

consequence of the drainage of the subsoil, the deaths from tuberculosis in that city were diminished by one half.

Now, I venture to say that many people will exclaim, "who would have thought it?" Who, on looking at a town, would have been able to divine that by some alteration in that which is wholly hidden from our gaze—the condition of the subsoil—you could, by a simple process, produce such a wide and beneficial result? That is one of the circumstances which we have to take into account.

Now, in this matter of habitation, one of the first necessities to which we have to look is that of efficient drainage; and that, again, is a very much wider subject than the public at large, perhaps, are apt to believe. When you talk to them of drainage they imagine that if the drain is put in there is an end of the matter; the work is done. But I think we know, as sanitarians, that there is a good deal more to be thought of. We have, of course, to consider, in setting about the work of the drainage of the town, respecting the removal of the sewage. What are you to do with the product? What are you to do with the sewage which you carry away? When the work of draining towns was first commenced that was thought to be very simple. The nearest river or the neighbouring stream was thought to be by far the most convenient receptacle for everything that was carried away from the town; but I hope we have all learned better things than these, and are beginning to understand that the very last place into which you should turn your sewage is that which is intended by Providence for giving one of the first necessaries of life to the population, and affording alike health and pleasure to all who are able to look on it or drink of it.

Now, in regard to this matter, I would venture to point out to you that a recent Act has given greater facilities for preventing the pollution of rivers and streams than existed before. The Local Government Act has placed in the hands of County Councils extensive powers, and it depends upon them to decide in what way those powers shall be used. If they are used firmly and efficiently I cannot doubt that a very considerable improvement in the condition of our rivers and streams will take place throughout the country. In this county, to which this evening I may be permitted more especially to allude, we have two fine rivers, intended, I think we may venture to say, by Providence for the supply of food, for the supply of pure water, for the purposes of health and recreation. But, so far as I have been able to judge, if things go on as they are, neither the Severn nor the Teme are likely to be useful for those purposes. I do not know whether many here will recollect the

beautiful lines in which one of the great poets of our country addressed the river Severn. He spoke of her as a lovely nymph:

> "Sabrina fair,
> Listen where thou are sitting
> Under the glassy, cool, translucent wave,
> In twisted braids of lilies knitting
> The loose train of thy amber-dropping hair."

That was Sabrina or the river Severn; but I can only say that if John Milton were now alive, and were able to look at some spots to which I could take him on the river Severn, where an outfall sewer is discharging its contents from the neighbouring town, he would begin to doubt whether if the tresses of Sabrina dropped at all it was anything like amber with which they dropped; and you know well that what I say of the Severn applies to the rivers to a very large extent throughout our land. Now, it will rest with our County Councils to say whether they will resolve that the powers which Parliament has given them—powers which I am convinced that public opinion will support if they are rightly exercised—shall be so used that this pollution can go on no longer. I am glad to say the County Council of Worcestershire have already taken the important step of addressing the County Councils of Herefordshire, of Salop, of Montgomeryshire, and other counties—I name only those three for obvious reasons—asking them to unite with us in forming (as the Act enables us to do) a conjoint board, for the purpose of preserving the streams of the Severn and the Teme throughout the whole length of their flow from pollution. But I regret to say that up to this moment our negotiations have been fruitless—not a single county has been found willing to join with Worcestershire in this good work, and I can only express my hope that wiser thoughts will ultimately prevail. It is useless or next to useless for a county to take steps to prevent the pollution of a stream within its own borders if that stream is to suffer contamination from towns and counties above. Unless the counties of Montgomery and Salop and Hereford will join with us in protecting the Severn and the Teme, those two noble rivers can never be free from pollution, and it is my wish, speaking here this evening to an assembly drawn from a much wider area than our County Council here can be, to appeal through you to public opinion, and to ask whether, when we are willing to do our utmost to save those two rivers, to keep them free from impurity for the discharge of the duties for which unquestionably in our belief Providence has created them—whether we are to be thwarted by the reluctance of

other counties to join in the good work by protecting the streams above, while we are willing to keep them pure below?

Now, ladies and gentlemen, with regard to a very vexed question—that is, the disposal of sewage—I would say a few words. I have myself a very strong belief that the best way of disposing of town sewage is to allow it to flow direct in a liquid form upon the land. It then passes through the natural purifier, the earth, and can be returned to the adjacent stream without doing any detriment thereto; and I have had before me in the Committee of the House of Commons to which I have alluded a remarkable example in the town of Reading of the success of such a system. Now, the town of Reading sends the whole of its sewage after it has passed through its sewers on to a sewage farm below the town. The sewage simply flows upon the land. As you well know, this greatly fertilises the land, and facilitates a rapid production, and the sewage farm is used for the purpose of feeding cows, who give a large milk supply to the inhabitants of the borough. Now, it seems to me that that is one of the best devices possible for the disposal of sewage. It answers every purpose; it is very quick; it is very easy in its operation; it is also highly beneficial. It disposes of the sewage immediately; it makes the sewage highly fertilising to the land; and at the same time it tends to supply the towns with an article which among an urban population is of urgent and daily request.

There is one detail with regard to the disposal of sewage to which I desire to allude. It came prominently before me during this last Session in the Bill promoted by the Corporation of Norwich, and it is a curious illustration of the defects which inevitably exist in technical legislation upon this matter, and the need for remedying those defects. The Corporation of Norwich applied for power to construct and maintain two different sets of sewers—one for carrying off the sewage, the other for carrying off the storm-water. I, in my ignorance, inquired why it was that they did not, if they desired to have a separate set of sewers to carry off storm-water, construct such sewers without coming to Parliament for powers to do so. Then it was properly pointed out to me that it was impossible for them to do so without Parliamentary powers; and for this reason, that although any sanitary authority can of course construct a separate system of sewers for storm-water, they cannot compel the householders to make any connection with their house-drains for that purpose. They have the power of compelling a householder to make a connection with the sewer by means of his house-drain for the purpose of carrying off sewage, but they have no power to compel him to make the

connection for the purpose of carrying off storm-water. Consequently, if they desire a separate system of sewers for storm-water, which, as far as I have been able to learn, is very desirable, especially where the sewage is intended to be used on a sewage farm, then they must come to Parliament for special powers for that object. We immediately granted those powers to Norwich, and unquestionably shall grant them to any other municipality that in future Sessions may apply to us for that purpose. But surely it would be far better that in the general law of the land there should exist a power enabling any sanitary authorities who desire it to compel householders to make connections with separate sewers for the purpose of carrying off storm-water.

I am anxious also to allude to another matter in connection with drainage—that is, to the absolute necessity of employing skilled and trained and intelligent labour for the purpose of making internal fittings. In the first place you make a house-drain to run into its sewer, and that is comparatively easy; but the question is are you sure that the internal arrangements behind are such as to convey into the drain, which is to run into the sewer, the sewage matter which you desire to be taken there. I have had within my personal knowledge a curious instance that the anticipated result—the naturally anticipated result—does not always follow. I remember in a building to which I will not allude more particularly—I well remember that with great pains the outside drains were constructed on the best sanitary principles, that the internal drain was made, and that it had been entirely believed that everything had been arranged in the most satisfactory way, and then it was discovered afterwards, when certain evils arose, that unfortunately the intelligent workman who had been employed to finish the arrangements had forgotten to make any connection between the internal fittings and the house-drain, and the consequence was that the whole of the sewage was pouring out under the floor of the place where the connection should have been made. I am told by those who have had considerable experience in the metropolis and other large towns that such events are by no means uncommon.

Now, I think a most excellent work has been done and is being done by the Plumbers' Company in London, in taking care that a body of men are trained who can carry out this work in an efficient and skilful manner, who hold examinations to insure that the men to be employed shall know their work, and who further keep as I am told a register of skilled and certificated workmen, so that anyone who desires to make sure that the man who is employed for this work really knows his

business has nothing to do but to consult that register, and he may be quite sure he will obtain what he wants. These are humble details, but on them, remember, health and life depend. A very small amount of neglect in sanitary work of this kind may lead to endless and terrible disasters in a household.

Then, on the subject of ventilation again there is a great deal to be said. I am afraid we all think too little of it, and certainly amongst those—and there are many in this country—who have not studied sanitary matters it is always difficult to discover whether they are aware of the benefits of pure air, and the necessity of letting external air flow freely through the house. In this connection I would call your attention to what I think is rather a remarkable exhibit in the exhibition—the Sanitary Exhibition—which was opened this afternoon in this city. I was very glad to see that a prize was given to this exhibit. I allude to the reversible window exhibited by Mr. Miller there. I had an opportunity when I was attending the British Association in Newcastle the other day of seeing the manufactory where these windows are made, and of having a specimen shown to me and the whole construction explained to me by the maker, and I have not a doubt that these reversible windows are most valuable on sanitary as well as upon other grounds. The windows can be operated upon by an ingenious system, so as at once to admit a free flow of air through nearly the whole aperture of the windows. On the ordinary plan of course each of the sashes will only let down or push up for a certain portion of the space; but in this case the sashes by being both operated at the same time admit at once a free flow of air through the whole extent of the aperture. At the same time they are productive of this other great advantage—that they allow the window to be cleaned from the inside upon both sides of the glass; and although that may be perhaps for many private houses no very great convenience, for public institutions, for hospitals, for schools, for places that have to be built in many storeys, it is an immense improvement. It is a sanitary improvement even, because it offers an opportunity for the more frequent cleaning of the window, and it is also an immense help in the way of saving danger to life and limb, by preventing the necessity for sending persons outside to stand on sills, or to clean the window under other dangerous circumstances.

Now, I would venture also, as I am sure I am speaking to many who are interested in municipal administration, to say in one word how important it is to all that there should be good by-laws in regard to all these matters in force under sanitary authorities. A great deal, as I am sure you all know, depends

upon by-laws. The general law can only for the most part lay down principles. It is through the by-laws of the various sanitary authorities that the real sanitary administration is carried out; and by having good by-laws with respect to all these questions of drainage with which I have been dealing, although you may not be able to remedy shortcomings with regard to old houses, you would be able to prevent the same defects arising in regard to new houses. Houses built after the by-laws had been enacted would have to be built on approved sanitary principles.

The second influence on which I would speak is that of occupation, and there again we are all perhaps apt to overlook the effect on health of the various occupations in which people are engaged. I had the pleasure this afternoon of saying a few words to some members of the Sanitary Institute at the Royal Porcelain Works, and I am sure from what I heard and saw that they all admired the beauty of the manufacture and recognised the success that has attended its development in this city. But I regret to say that there is no question that the pottery manufacture here as elsewhere has often been productive of disease amongst the operatives. I am glad to know that in our factory those causes of ill-health have been to say the least very largely diminished. Anyone who in going over the works will look at the old rooms and then look at the new rooms will see what an immense amount of improvement has been introduced in the matter of cubical space for those who are working, and also the improved ventilation which is everywhere characteristic of the new buildings; and in that way no doubt a great number of the causes of disease have been prevented. But I fear that even still there are artisans who suffer from the occupation, and it will be our duty as it is our interest—when I say ours, I mean everyone interested in the porcelain works—to see that as far as possible those causes shall be done away with. And it is consolatory to know that invention is always at work to diminish the causes of disease.

I was present at Newcastle the other day when a very interesting paper was read upon a recent invention which I believe will almost entirely remove the causes of mortality in one important industry in this country. I mean with regard to the making of bottles. A Mr. Ashley has invented a machine which will do away with altogether, or, at any rate, will largely diminish, the process of what is called bottle blowing. As many of you probably know, the old way (the present way) in which a bottle is made is by the operative blowing through a tube, blowing out the melted metal, which is heated to an almost incredible temperature, blowing it out

with his mouth at one end of the tube until it forms a bottle at the other end of the tube. Well, the consequence of the glass blowers breathing the enormously heated air which is produced by the molten glass—how hot it is I should be afraid to state, because I do not exactly remember—and the consequence of their applying their mouth to the tube in which this metal is contained is so destructive to the throat and lungs that few bottle blowers live beyond the age of 32. I believe the average age of a bottle blower is still lower, but very few live beyond the age of 32. Now, as I said in the discussion of this paper the other day, I believe if this great mechanical invention (of which more than one expert then present spoke with admiration) can only be used throughout the country, the result will be that the occupation of a bottle maker will be just as healthy as that of any other artizan, and one cause of disease and death will have been removed from the industry of the country.

Very often these appliances are not used because they are disliked by the men employed. It rests with Societies like this to spread a knowledge of sanitary truths throughout the country among the great bulk of the population, so that working men may become alive to their own interests, and be ready to adopt the beneficent means constantly being devised to improve the various industries in which they are engaged. There is another leading influence which acts upon health—the influence of the food which we take. A great deal might be said on this subject, coupled with that of adulteration; but I am not going to dwell upon it. But there are two matters on which we ought to exert ourselves to prevent evil to the people. One is with regard to the water supply. Unhappily in many towns of this country the water is not really pure. It is very often believed to be pure when it is not absolutely free from the elements of disease. Knowing as I do the difficulties under which many municipal authorities labour in this question, I would not for one moment impute to them anything but a desire to preserve the health of those whose lives are entrusted to their care. But I do say the question of a really pure water supply is one which every sanitary authority throughout the country should be constantly bearing in its mind. It means a question of life or death to the people. It means constitutions constantly injured even when death does not ensue, and when the quality of the water itself, even though not absolutely impure, requires constant attention. There is another liquid to which attention should be directed. It is not even yet generally believed that the evidence of facts is the best way of calling attention to a matter of this kind. But I

can give you from the records of the Local Government Board, which have been most kindly placed at my disposal on this subject, the particulars of cases in which disease of the most terrible nature has been traced to milk. One is the famous Hendon Case, of which no doubt you have all heard.

In that instance disease was extensively spread throughout a considerable district of London by the supply of milk, as it was believed, from a particular farm. An outbreak of scarlet fever took place wherever this milk was distributed. Where the milk went there was scarlet fever. I could not say that everyone who partook of the milk had the fever, but in every district in which it went there was a large percentage of scarlet fever. I am well aware of the controversy which raged, and which, no doubt, still continues, or which might be stirred up even out of the smallest provocation in relation to this case. I know well that two health departments of this country were at issue upon the question, and therefore I speak with reserve; but, after studying the facts of the case, I venture to say it might not settle the question scientifically, but it might perhaps settle it practically, if the issue whether the responsibility for the outbreak attached to the milk or not was submitted to a jury of twelve educated and intelligent gentlemen. And with all the facts before them, I cannot imagine a jury which could find any other verdict than that the scarlet fever came from the milk. Of course, there are scientific questions behind the open question of ordinary deduction from fact; but I maintain that, as a reasonable man guided by the ordinary weight of evidence and fact, I could not possibly arrive at any other conclusion than that the outbreak of scarlet fever in that case did result from the consumption of milk from that particular farm.

The Veterinary Department seem to have taken up their position as if with an instinctive dislike of the idea that cows could be in any way to blame.—"How do you know but that there was somebody who went from a scarlet fever case to this farm, and took the infection of scarlet fever with him, which was taken up by the milk and re-produced scarlet fever in the persons to whom the milk was supplied?" My answer must necessarily be that I could not possibly accept a mere hypothesis as against actual facts placed before me. There is no proof whatever that any human being carried the scarlet fever to that particular farm, and that not being proved, and there being no evidence of any possibility of the transfer of contagion in that way, the only supposition is that it was in the milk itself. It was ascertained that most of the cows on that farm were suffering from a disease, slight in itself so far as the cows were concerned, and which simply bore so close a resemblance

to the ordinary vaccine disease, which is a prophylactic against small-pox, that one might have easily been mistaken for the other, but that this disease, on examination, proved to be of a distinctive character. That of itself would not have been sufficient proof that the disease poisoned the milk of the cows with scarlet fever. But then came this extraordinary fact, that there was one cow which had not that particular disease. She had come from another part of the country, and she remained healthy during the investigation taking place week after week by trained officers of the Local Government Board. And it was proved that her milk was, in the first instance, mixed with the milk of other cows. It was all thrown together and distributed together, and scarlet fever ensued amongst the people who partook of that milk. During the investigation it was thought important to keep the milk of the one cow separate. This was done and the milk was sold separately, and no person to whom that milk was sold had scarlet fever. It was then mixed again, and it was found that scarlet fever arose amongst those to whom it was supplied. I want to know whether that is not sufficient legal evidence, to say the least of it, that it was the other cows which infected the persons to whom the milk was supplied.

I have no doubt, morally, that the disease in cows, by whatever name it is to be known, is capable, through the agency of the milk, of conveying scarlet fever to human beings. When thinking that over it is impossible to avoid becoming impressed with a very strong conviction as to the care there ought to be taken by all sanitary authorities in carrying out the provision of the Dairies' Order in respect to the healthy or unhealthy conditions of the cows who supply to the dairies their milk.

There is another remarkable case. There was a dinner party at South Kensington. Sixteen people sat down. There were, of course, a certain number of servants in the house, and there were 150 people who came to an "At Home" in the evening. Now of the sixteen people who dined seven were seized with scarlet fever in a very short period. Several servants were seized with the scarlet fever also, and not a few of the people who attended the "At Home" were similarly stricken down. There was an accurate investigation by an official of the Local Government Board, who could find nothing in the ordinary sanitary conditions of the house which would in any way explain the matter. It was shown that two children of the house who had been sent away the day before this party was given had remained healthy, and the question was to what positive cause could the outbreak be attributed. I desire at this point to be permitted to express my admiration of the way in which these

inquiries are conducted by the officials of the Local Government Board. I have necessarily during my life had something to do with public inquiries. I have been cognisant of and presided over the most searching and accurate investigations in Courts of Justice by able counsel. I have sat on Royal Commissions on which we had the advantage of the most highly-trained assistance. But I venture to say that in nothing in which I have been engaged have I been more struck than by the painstaking, laborious, and truly scientific method of investigation adopted by the officials of the Local Government Board in inquiries relating to sanitation. Well, the official who inquired into this case tracked the question through all the various occupations of the household, the varied character of every food, until he arrived at the conclusion that it must have been something that had been eaten at the dinner and at the "At Home" which had produced the outbreak. He tracked it until he came to the cream that had been supplied, and he found that no person had been attacked with scarlet fever who had not partaken of this cream, and nearly all of those who had partaken of it had been seized with the fever. It was the same with the servants. The cook and the kitchenmaid had tasted the cream preparation, and they were seized with scarlet fever, while the servants who had only handed it about had escaped harmless. That is a remarkable proof of the necessity for watching over the management of dairies. Nothing was discovered in that case which could incriminate the keeper of the dairy; but it was undoubted that, from some influence or other, from some infection of the cows or some peculiar condition of the premises not ascertained, that cream had in fact the poison of scarlet fever, and had given the fever to nearly everyone who partook of it. There has been nothing over which I have watched with more care in the many local sanitary Bills I have had before me than this question of the milk supply, and I perceived early this difficulty, that a sanitary authority might be armed with full powers over the dairies within their own territory, might be able to carry out the most stringent methods of keeping the dairies pure, and might prevent milk being sold which was even open to the suspicion of disease or infection; but that in the great majority of cases towns were supplied from dairies outside their limits, and out of their jurisdiction. Consequently, the laws which gave them the powers within their own boundaries were inoperative in regard to those outside dairies which supplied the town.

Some sessions ago, as Chairman of the Committee to which I have alluded, I caused clauses to be prepared which have now been introduced into a number of local Acts, and which

give a Corporation power, not merely to regulate the dairies within its own jurisdiction, but also to exercise jurisdiction over all dairies whether within their own territory or not, whether near or distant, which have been proved to supply milk to the population within the boundaries of the town. I was convinced that exceptional authority, a great extension of municipal power, must be given if you are to preserve a pure milk supply for the inhabitants of boroughs, and I hope that Parliament will in this case see fit to do what it has done in several other cases, and make laws passed for individual places, which have been proved to work well, universal all over the country. I am glad to say that there has been an Act passed during the last session which exactly answers to that description—an Act which has been made universal throughout the country after it has long been local and exceptional. I mean the measure for enforcing the notification of infectious diseases. I have always been most particular when Bills for the adoption of these powers have been brought before me to enquire whether there has been any complaint with regard to the exercise of the powers in any of the boroughs where they had been already enforced; and I have failed to elicit proof of a single instance in which there had been any complaint of misuse of these powers, or of any evil result therefrom. This in itself is a very considerable proof that they have been solely beneficial. I am convinced that they have been productive of enormous benefit. In a great number of cases this system has been the means of stopping the spread of infectious disease at its outset. It does so by the communication to the Medical Officer of Health of the first intelligence of an outbreak of any infectious disease, whereby he is able at once to proceed to the spot, and take all necessary steps to prevent its spread. Infectious disease is very like a fire. If a fire takes place, a bucket of water may put it out at the beginning; but a fire engine might be impotent to stop it if it is allowed to have half an hour's start. It is so with zymotic diseases. Dealt with at the moment they arise, the first case promptly isolated, the outbreak would probably go no further. Left alone for a week or two, allowed to spread and get a hold, there would be some such outbreak as is now seen in the neighbouring city of Birmingham almost at our own doors, where an outbreak of scarlet fever is at present seen, even nurses having been stricken down, and the whole population being at its mercy. I cannot help remembering, and I hope the men of Birmingham will remember, that when they had a few years ago a Bill for enlarging their municipal powers, it was proposed to them, and recommended to them by some who knew the subject well, that they should avail them-

selves of the clauses for the notification of infectious disease. But in an evil hour they rejected that counsel, and refused to adopt the system of notification. I venture to say that the present outbreak would have been impossible if the Medical Officer of Health of Birmingham had had prompt notification of the first outbreak, and an opportunity of proceeding to the spot to stop its further spread. I will venture to give you, from my own experience, which happened in this city, an instance of the absolute necessity for taking precautions against scarlet fever. I had the honour of occupying for twelve years the position of Chairman of the Worcester School Board. It was my custom to drive into Worcester every Monday morning to receive a report from the attendance office of those children absent from school without cause. One morning there was the name of a little boy who had been absent for some little time. As I was going out of the building I met a little girl older than the boy. I knew that she was the sister of the child, and I said to her, "Why is it that your little brother is away from school?" Her reply was, "Please sir, he has the scarlet fever." I said, "That is a most excellent reason for stopping away; I hope he is getting better." "Oh! yes," she said, "the skin is peeling off him nicely." In other words, he was in the most infectious stage. I said, "Who has been nursing him?" She replied, with that air of virtue little girls assume when they have done a good action, "I have; I have had him in my lap all the morning." "Where are you going now?" I said. "Please, sir," she replied, "I am going to school." Here was a child as fully charged with the poison of scarlet fever as a galvanic battery is charged with electricity, going into a school of 150 children to spread the contagion right and left among everyone she touched. We have in this city, as I am sure you well know, for he is doing good service indeed, a most excellent Medical Officer of Health, Dr. Strange. If he had known that child was suffering from scarlet fever, I will venture to say he would have been promptly on the spot to take care he was shut up in the house, and that no one who came in contact with him was going into a place of public resort. But Dr. Strange did not and could not know it, because there is no system of notification in the city of Worcester; and in this city you may have scarlet fever, diphtheria, and other diseases of the most contagious and infectious kind, and the Medical Officer of Health may not know of it unless his attention happens to be called to the case. The object of this Act is to ensure that the medical officer shall know whenever any case breaks out. The Act provides that the attendant shall send notice to the medical officer at once of any case of infectious

disease, and I will venture to say that, if this system be effectually carried out, you will see a great diminution of zymotic disease throughout the country. It will come into force on the 1st of October, and then between eight and nine millions of the population of this country will have been placed compulsorily under the system of notification.* I was most anxious that it should be made compulsory over the whole country. I placed amendments on the notice paper to that effect, but I was compelled to drop them because it was found that the patriotic zeal of the Irish members, who had nothing whatever to do with the Bill, caused them to resolve to defeat it if possible, and the only way to avoid that defeat was to drop the amendments, and unite in getting the Bill as it stood through the House. It has been left optional to sanitary authorities throughout the country whether they will avail themselves of this system or not. I trust their good sense and patriotism will enable them to take the righteous step of bringing the Act into operation in their own localities. It is by such a system as this that you can save thousands of lives, which without it will unquestionably be sacrificed.

Upon this matter, as upon all others, I venture to say that the whole sanitary question resolves itself into the giving of an answer to the words which were pronounced by One whose utterances we must all, as Christians, listen to with profound humility and reverence. The author of our faith when pressed upon a matter of health on one occasion gave this answer: "Is it well to do good or to do evil, to save life or to kill it?" It is recorded of those to whom these burning words were addressed that they held their peace. They were struck dumb by the Divine scorn of their hard-heartedness and their wilful blindness to the plain truth before them. I am sure none present this evening require those words to be addressed to them. The very existence of this Institute shows that you desire to save life and not to kill it. But there are many in this land, who, through ignorance—for I know it is ignorance only—are willing rather to kill life than to save it. They are willing to indulge in their own apathy and prejudice and opposition to all change and improvement rather than to recognise the plain truths that are laid before them, to follow the path that lies clear under their eyes, to walk straight to the great prize of giving life and health to all around them. If those engaged in the work of sanitation will only persevere, if they will only bring public opinion

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* That is, about five millions are already under notification by provision in Local Acts, and about four millions inhabiting the Metropolitan area will at once be brought under it.

to bear upon the causes of disease and death, they may rest assured that they will compass the noble words of the great poet of the day:

> Oh! still we trust that, somehow, good
> Will be the final goal of ill;
> From pangs of nature, sins of will,
> Defects of doubt and taints of blood.

These words apply peculiarly to all sanitary questions. We know there are great evils to grapple with. We know there are terrible diseases amongst us. But if we will persevere and bring the force of truth to bear on the causes which produce these diseases we may be assured that they will ultimately vanish, and health, vigour and long life be the inheritance of every man and woman borne into this land.

The Mayor said that he was pleased to be the first person to be able to congratulate Mr. Hastings upon the distinguished position to which he had been appointed. Mr. Hastings had opened his address by stating that he accepted that important position with diffidence, but he had shown by the ability with which he had addressed them that he was more than fully qualified to occupy that distinguished position. If it were necessary to give them any further illustration of Mr. Hastings' fitness for the office, he would take them back to the lifetime of his late illustrious father, Sir Charles Hastings, a man eminent in his profession, and a citizen who yet lived in the hearts of the inhabitants of the Faithful City. His memory remained in the minds of the citizens more particularly from the fact that he belonged to that most useful of professions, the medical, and he believed that Sir Charles Hastings was the means of founding the British Medical Association. That Association was now identified with the majority of men connected with the medical professions, and therefore, taking those grounds into consideration apart from personal merit, he thought the Institute might congratulate itself upon having Mr. Hastings as its President. Although he agreed with many matters to which Mr. Hastings had alluded, he held a slight difference of opinion from him upon the subject of irrigation as regarded the disposal of sewage. He was prepared to admit that the system was a good one where the soil and circumstances were suitable, but he was strongly of opinion that the system of precipitation was far more preferable in many cases. In conjunction with a small system the irrigation principle might act successfully. But the *modus operandi* of the disposal of sewage was at the present time the cause of much difference of opinion amongst scientific men, and there was yet great doubt

as to the best method of treatment. He hoped that the counties who had not yet joined with Worcestershire to keep the water of the rivers running through them pure would soon be brought to a wiser state of mind. In conclusion, he proposed a vote of thanks to the new President for his address, and said that they owed him a debt of gratitude for bringing the various subjects before them in so practical a way.

Mr. MICHAEL, Q.C., in seconding the vote of thanks, said that to the labours of Mr. Hastings, Lord Brougham, and other men who worked at the problem of public health when it was extremely unpopular, they owed the present advanced state of knowledge upon the various subjects which made up the health and wealth of the nation. He had had many opportunities of judging how valuable was the work done both in and out of Parliament by Mr. Hastings; and there was no one more competent from having personal acquaintance than he (Mr. Michael) to speak of his great worth, which could only be known by those who had worked with him.

Mr. HASTINGS replied. He said he had not sought to raise any controversial points as to the best method for the disposal of sewage. He was only stating his own personal conviction, founded on observation, that where the system of disposing of sewage in a liquid state on the land could be carried out it was the best possible mode. There were many cases, however, where it might not be possible, and then they had to consider the next best method. The example of the town of Malvern, which deposited the whole of its sewage on a sewage farm, with, as far as he knew, the best possible results, had been one fact which led him to arrive at a conclusion as to the best practical method of disposing of town sewage.

SECTION I.

SANITARY SCIENCE & PREVENTIVE MEDICINE.

ADDRESS,

By George Wilson, M.A., M.D., F.R.S.E.,

President of the Section.

In addressing you to-day, my first duty is to thank the Council of The Sanitary Institute for the honour they have conferred on me in inviting me to preside over this section of the Congress. It is an honour which I can assure you I accepted with no small amount of diffidence, and even now I feel that perhaps my best presidential contribution to our proceedings would be to sit here as a respectful listener. But it has always been customary on these occasions for the Presidents of the several sections of the Congress to deliver an address, and I am afraid I would lay myself open to a charge of something akin to indolence if I ventured to depart from this custom. I must therefore crave your indulgence for a brief space, and will frankly assume that neither in the selection of my subject nor in its treatment will you expect anything very striking or very new; that in fact, you will be contented with what may be called some general talk on the subject matter of our section. I will endeavour to bear in mind too, that while addressing you I have the opportunity afforded me of appealing to a wider audience, and that in the selection of a suitable theme, I ought to pay due regard to that consideration. Chiefly, then, in that point of view, and with intentions of a practical kind which I hope will explain themselves as I proceed, I have decided to offer you some remarks on "The Policy of Prevention in some of its Social and Sanitary Aspects."

In commenting upon such a well-worn theme as this, I must trust to you for indulgent criticism, because the problems involved

are in themselves so varied and intricate, and the field thrown open for survey is so extensive, that in a short address it is only possible to touch on isolated phases of the subject. Now I need hardly say at the outset that the policy of prevention to be effectual implies a clear knowledge of the causes of disease. These were so ably discussed by Prof. Russell Reynolds in his address to this section of the Congress held at Bolton two years ago, in so far as they relate to domestic hygiene, that if I allude briefly to some of them, I do so only for purposes of practical application. First, then, let us glance at the long roll of diseased conditions and premature death which depend upon the laws of heredity:—hereditary consumption, scrofula, gout, syphilis, cancer; hereditary insanity and nervous ailments; hereditary criminality; hereditary intemperance; hereditary vagrancy. Or let us consider for a moment the multitudes of maimed and doomed offspring which result from other unsuitable or imprudent marriages, apart from those of diseased or unhealthy parentage. Now, without discussing over-population theories, it is evident that when a man marries, no matter what his age may be, at a time when he can barely earn his own subsistence, and when he has no other resources to look forward to, he runs the risk of begetting a family which he cannot rear without the aid of pauper relief. The consequence is, that this unthriftiness in marriage, prevailing as it does among the ignorant and degenerate, leads too often to intentional neglect of the children amounting to culpable homicide. It largely accounts for that inhuman form of false thrift, which, under the name of infant life-assurance is spreading its baneful influence even into innocent village communities, and not only tempts to neglect, but too often seals the doom of the hapless offspring. But public feeling is gradually being aroused to the enormity of this insidious onslaught on infant-life, and there are at last hopes of effective legislative interference.

But cannot legislative interference go a step further? It is very doubtful whether public opinion is yet so far advanced as to warrant the legislature in enforcing a certificate of health on the part of persons about to marry; but I do think the time is at hand to put some check on the appalling waste of infant life which disgraces our civilization by prohibiting any man to marry unless he can produce reasonable proof that he is in a position to maintain a wife, and by absolutely prohibiting the marriage of any man who is still an infant in the eye of the law,—that is, under the age of twenty-one years. It is true that in this instance the law insists upon the consent of the parents or guardians, but as regards the artisan and labouring classes, among whom early marriages, with all their baneful

consequences, are so prevalent, such a condition is a mere mockery. Indeed, as regards all classes, it may be said that too early marriages—like marriages which take place too late in life, if not infertile—result in the birth of children afflicted with a lowered vitality. And not only so, but how often do we see the very young mother become a permanent invalid, barely able, if at all, to nurse her children, and through the ill-health induced by a too early marriage, imparting to her offspring a vitiated heritage. So numerous are cases of this description, that physicians who have carefully studied the subject maintain that no woman should marry before she is twenty-one years of age; and as regards the other sex, it may generally be said that the responsibilities of married life would be all the more safely faced if marriage were delayed till the age of twenty-five. But here I am afraid I am touching on ground which perhaps lies outside the scope of the policy of prevention. Let me only say in passing, that the Church, which holds the sacred rite of marriage under its special sanction and protection, has a vast mission field before it in which to preach and teach those undeviating laws of heredity which stamp their impress for weal or for woe on every child which is born, and on every succeeding generation.

This, however, by the way; let me rather refer to the vast amount of sickness which might be averted and the number of lives which might be prolonged to mature age if ordinary medical practice were based as much on preventive as on curative lines. And this, perhaps, applies as much to hereditary proclivities and ailments as it does to the ordinary diseases of daily life; for the power of the physician to combat inherited disease lies not only in warning against ill-assorted marriages, but implies (and here I quote Professor Russell Reynolds) "the special guidance of tainted children by all measures that can be used or devised for the purpose, by controlling moral, mental, social, and physical education, and regimen of life. This must be commenced before birth, continued in the nursery, and school room, and maintained during manhood, and even to declining years."

But apart from the inherent causes of disease which are included under the general term *heredity*, there is a long list of other causes which, beginning with parental neglect or ignorance in the rearing of children, or in early training, are in after years largely under individual control, and are therefore, in the strict sense of the word, avoidable. For underlying the whole art of prevention is this great truth which has been established by the researches of the physiologist that the animal organism is intended by nature to pass through a prescribed

period of existence from natural birth to natural death, and that it is incapable in itself of originating any of the manifestations of disease. We have, therefore, to look outside the body for influences or agents which operate as causes of disease in all its multiform phases. The great bulk of these belong to the domain of domestic hygiene, and depend mainly on a personal disregard of the laws of health, often through ignorance, sometimes through indifference, while many of them are associated with the usages and exactions of society. I need not attempt any scientific classification of these causes of disease, but the mere enumeration of the more prominent amongst them will suffice to prove how wide and varied is the list, and what a fruitful source they are of preventable disease and premature death :—errors in diet, abuse of the luxuries of life, worry and over-work, idleness, want of self-control, irregular modes of life, errors in clothing, and, above all, intemperance. It is these causes of disease, and not so much those which come more or less under legislative control, which help to keep the ordinary medical attendant busy, and which crowd the consulting rooms of the fashionable physician.

It is true that diseases resulting from impurities in air and water, unwholesome or insufficient food, and zymotic contagions still contribute largely to ordinary medical practice, but year by year they are becoming less prevalent, and all along the victims have been most numerous among persons receiving pauper relief, or among those entitled to the benefits of clubs or dispensaries.

But, with regard to ordinary family practice, the incongruity which, with all due deference, I would submit is this :—that while preventive medicine, whether in its social or legislative aspects, owes all its success to medical research, the teaching of it is practically ignored in most of our medical schools, and the practice of it is detrimental to the pecuniary interests of the profession. To speak plainly, there is no disguising the fact that so long as the family medical practitioner continues to be paid to attend only on people when they are ill, and not to conserve the health of the household, there will be a constant drag on public health progress. He earns his living by disease, and so far as he prevents it he is placed in the unfortunate position of being out of pocket. He is, therefore, exposed to this temptation—a temptation which, I am proud to say, is scorned by the profession generally,—that, when called upon to treat cases of preventable disease, whether social, sanitary, or communicable, he need give no warnings nor insist upon any precautions.

I do not blame :—the fault lies in a system of practice which

depends upon the regrettable fact that, in spite of advancing knowledge, public credulity in the power of cure still reigns paramount, while public faith in prevention is practically dormant. I venture to assert that there are few medical practitioners who would have the courage, when called upon to attend a case of illness in which a change of regimen is alone required and medicine useless, to order the regimen and omit to prescribe the medicine. Whether he requires it or not, the average patient must have medicine in some shape or form, or he believes he is badly treated. Homœopathic globules are as harmless and will often do him as much good as anything else he can swallow, for after all, in the great majority of cases, the so-called cures are to a large extent faith-cures:—the *vis medicatrix naturæ* does the work, and the doctor merely assists nature's efforts. Not that I wish in the slightest degree to decry the triumphs of therapeutic art; I admit to the fullest extent that the physician can always alleviate and often cure; all I wish to insist upon is this:—that the power of cure is infinitesimal when compared with the power of control.

But I refrain from saying hard things. Let me rather point out briefly how curative and preventive medicine may go hand in hand for the promotion of public health and the abatement of human suffering. And this is a matter in which the public themselves must take the initiative. It is a question which has been previously discussed by others as well as myself, and by others much more than myself, notably by Dr. Ogle, of Derby, who has long advocated this change in family practice. All that is required to bring about the change is this—that the ordinary medical attendant should be paid by an annual stipend or retaining fee, and not according to the number of visits which he may deem it necessary to make during illness. This system is largely followed in India and other places abroad, and no difficulty is experienced in settling what shall be the annual fee for professional services rendered in this way. It is true that in this country the same kind of practice prevails to a certain extent. For example, the proprietors of mines and other large works pay medical men so much a year to attend on their workpeople; while members of sick clubs, friendly societies, provident dispensaries, and paupers are also attended in this way; but the misfortune is that the great majority of these appointments are scandalously underpaid, because they are regarded by medical men as stepping-stones to general practice.

And now as regards the advantages of this system of medical providence or health-assurance as it has been called, from a preventive point of view. In the first place, then, the medical attendant would inquire into the health-history of the house-

hold, so that he might take precautions against inherited tendencies, or warn against bad habits, errors in diet and clothing, and the numerous risks to health which are common in daily life. In the second place, he would interest himself in the sanitary condition of the home and its surroundings, so that any defects might be at once inquired into and remedied. In the third place, he would make it his duty to call from time to time without being sent for, to see how the different members of the household were going on, and would thus have the opportunity of sometimes detecting ailments in the bud, so to speak, which, if not attended to at once, might lead to serious illnesses. In the fourth place, he would take every precaution in cases of infectious disease, and would have no scruples in giving timely warning to the sanitary officials for the protection of the public health.

As regards the profession itself, as the late Dr. Farr so forcibly put it, "Service would be greater, pay higher and easier, and consulting practice would remain what it is." There would be no longer any temptation to the running up of long bills on very slight pretences, there would be much less opportunity for the practice of quackery of all kinds, and altogether the dignity of the profession would be raised, and its usefulness greatly extended. Nor need there be any difficulties encountered in speedily bringing about this change in medical practice if the public generally can only be made to appreciate the vast amount of good which would inevitably result. Heads of households and private individuals in the upper and middle classes would of course pay any annual fee which might be agreed upon, while those belonging to the artisan and labouring classes could secure health assurance and medical attendance by enrolling themselves as members of sick clubs, friendly societies, and provident dispensaries.

But I need not enter into fuller details. If I have been tempted to dwell somewhat at length on this phase of the policy of prevention, it is because I am fully persuaded, and cannot help saying that in these days of advanced and advancing knowledge of the causation of disease, general medical practice as it has hitherto been conducted is an anachronism, and indirectly a stumbling-block to public health progress.

Let me now, however, turn to the sanitary aspect of my subject as illustrated in the domain of public hygiene or state medicine. It is in this direction that the policy of prevention has been attended by the most gratifying results, and year by year becomes fuller of hope and promise. In preventive, just as in curative medicine, it sometimes happens that consequences of immense value follow a chance hit of discovery, or some happy

inductive inspiration as Jenner's great discovery of vaccination as a protection against small-pox, but as a rule we can only know how to prevent by first knowing how to cause. And this study of causes, in proportion as it is conclusive and exact, can only be based on the lines of strict scientific experiment and research. On the one hand we have the comparatively few experiments which are conducted in our pathological laboratories on animals, and on the other, we have the numberless crude experiments conducted on man under the ordinary social and physical conditions of life, which are illustrated in the prevalence of particular diseases, or in special outbreaks of disease. In the former class of experiments—those on animals, the physiologist operates with a special virus or deliberately prepared cause in order that he may study its effects; in the latter class of experiments—those upon man, the trained expert tries to trace certain effects as represented by particular diseases back to their exact cause or causes.

Now I am not going to detain you by entering into any detailed account of the laboratory experiments, which may justly be regarded as having largely assisted in the policy of prevention; but I may be permitted to say in passing, that the studies, notably of M. Pasteur, beginning with the facts of fermentation and putrefaction, and proceeding onwards to inoculation by different kinds of attenuated virus, have opened up fields of research of the greatest promise. He, along with Koch in Germany and Klein in this country, supported by a large following of earnest investigators, has gone far to prove that what has hitherto been called "the germ theory of disease," is rapidly approaching a positive demonstration; that indeed as regards some of the diseases, which spread and destroy by their powers of infection, the specific germs, or micro-organisms, can be separated from the blood or excretions, studied and photographed under the microscope, and cultivated in test tubes with as much precision as the gardener can his seeds. They have also shown in their experiments on animals that by successive cultivations the destructive power of these micro-organisms can be so minimised that inoculations with the attenuated virus, while of full protective power against the specific diseases, produce very little constitutional disturbance in the animal experimented on. Thus it has been proved in respect to that fatal disease, anthrax, which sometimes devastates whole herds of cattle on the continent, and which is not uncommon in this country, and is communicable to man, that the virus can be so mitigated that an animal inoculated with it, instead of being exposed to almost certain death, has in reality no serious illness, and is protected from any future liability to the disease. So, too, with another

disease, which is known as chicken or fowl cholera. M. Pasteur has demonstrated that vaccinations with the attenuated virus of this fatal poultry disease protects against future attacks without causing any symptoms of serious ailment. In these experiments we have illustrations of the protective power which the attenuated virus of certain diseases may exercise in their prevention, just as vaccine lymph, which may be regarded as the attenuated virus of small-pox, acts as a preventive against that fell and dreaded disease.

With regard to M. Pasteur's more recent work in respect to the prevention of hydrophobia in persons bitten by mad dogs, perhaps it is still necessary to speak with a certain amount of reservation. For my own part, I cannot help believing that the statistical results of his treatment so powerfully support his theory, that it becomes a duty to afford persons bitten by rabid animals the opportunity of submitting themselves to this form of protective inoculation. In referring to this question I know I am alluding to a subject which is still open to much contention; but I think it may be fairly asserted that while the risk of any harm resulting from inoculation is infinitesimal, the chances of escape from an attack of that terrible disease, hydrophobia, are enormously increased.

But experimental work on animals has recently raised other issues of immense importance, and more especially in respect to the propagation of certain diseases of animals to man. For example, the experiments with the bacillus of tubercle—the characteristic micro-organism of that most fatal disease, consumption—open up questions of the gravest kind in respect to our milk supplies, and, in no small degree, to our consumption of butcher-meat. It is well-known that tuberculosis or consumption prevails to a very large extent in crowded dairies, that milk from tuberculous cows is largely consumed, and that the flesh of many of these animals when slaughtered, is eaten as human food. Now, it has been proved by microscopic research, that the micro-organisms characteristic of this disease can be detected in the milk of the animals so affected, and in their flesh. It has further been proved that animals fed on tuberculous flesh speedily contract the disease, and there are strong presumptive grounds opened up by other experiments for believing that animals fed on tuberculous milk become likewise infected.

Then again, there has recently been raised the grave question, which the President of the Congress so forcibly illustrated in his address of last evening, whether cows do not suffer from a disease which is identical with the scarlatina or scarlet fever of the human subject, and whether this disease may not be communicable by the infection of a specific micro-organism. Dr.

Klein's experiments on animals in connection with a well-known outbreak of scarlatina at Hendon, which was investigated by Mr. Power, of the Local Government Board, certainly strongly corroborate this view, though the evidence cannot be said to be conclusive.

But the policy of prevention in its sanitary aspects, may still be said to owe all its success to the long series of skilled inquiries into the distribution of disease throughout England and the circumstances by which it is regulated, which in the first instance were more intimately associated with the labours of Sir Edwin Chadwick, and later on with the distinguished public services of Sir John Simon. It would occupy too much of the time at my disposal were I to attempt to give even a brief sketch of the largeness of scope and variety of these inquiries—inquiries into the sanitary condition of our large towns, the housing of the poor, industrial occupations, excesses of disease resulting from conditions of filth, polluted water-supplies, defective drainage, unwholesome or tainted food and the like; but I may be allowed in passing to refer in general terms to the practical outcome of several of the more recent of them, as illustrating that wider field of research to which I have alluded, namely, the tracing of effects back to their causes.

Reverting, for example, to the dangers attaching to our milk supplies, it has been proved that whether or not there is a cow disease, which is communicable as scarlatina to man, there have been several outbreaks of diphtheritic sore throat, which have been clearly traced to some diseased condition of the cow, probably affecting the udder or teats. We know, too, that in numerous outbreaks of scarlatina, milk has been the medium in which the contagium of the disease has been distributed; and we also know that in many outbreaks of typhoid fever the disease has been propagated by washing out the milk cans or diluting the milk with sewage-polluted water, or water tainted by the specific typhoid contagium. Indeed, the dangers which lurk in our milk supplies have been so clearly established by numerous inquiries into special outbreaks of disease, that many maintain that the only safe preventive measure is always to boil the milk so soon as it is received into the household; while, as a public preventive measure, the State has rendered it obligatory on all sanitary authorities to enforce the provisions of the Cowsheds, Milkshops, and Dairies' Order: an order which, I regret to say, has hitherto been practically ignored in most parts of the country.

But I am afraid I am wandering somewhat from the strict lines of my subject. I have, however, introduced these instances as illustrations more or less instructive in themselves of the

methods of research which are essential to effectual sanitary defence and sound sanitary legislation:—first, the trained expert inquires into the causes, and supplies the exact knowledge as to the mode of propagation and means of prevention, and then the legislature, by various enactments (almost all of which have been passed within the last forty years), undertakes that the knowledge thus acquired shall become useful for the protection of the community. I need not refer in detail either to the wide scope of these laws or to the administrative machinery by which they should be carried out; but I may say in passing, that if the intentions and principles which they affirm were carried into full effect, they would speedily reduce to quite insignificant proportions the very large amount of preventable disease associated with sanitary defects or sanitary shortcomings which still exists. These causes of preventable disease have been grouped into two great classes, namely, local conditions of filth and nuisance, polluting air and water, and reckless dissemination of contagion. And, as regards both these wide fields of disease causation, large powers have been conferred on sanitary authorities, and obligations expressly imposed on them to remove the former and to see that means of isolation and other protective checks are fully and fairly carried out in respect to the latter. Not that I wish to infer that progress has not on the whole been very gratifying—indeed, the statistical returns of the Registrar-General furnish the fullest proof that the lowering of the general death-rate has been steady and continuous ever since the passing of the Public Health Act, 1872, when it may be said the administrative machinery of sanitation was first set in motion throughout the country by the establishment of urban and rural sanitary authorities, and the appointment of sanitary officials. Thus the average death-rate of the country during the five years ending 1870 was 22·4 per 1,000 of the population; during the five years ending 1875 it was 20·9; during the five years ending 1880 it was 20·0; during the five years ending 1885 it was 19·3, while the average during the last three years has been still further reduced to 18·7 per 1,000. This reduction from the average of 22·4 per 1,000 during the five years ending 1870 to the average of 18·7 during the past three years, represents an annual saving of 95,000 lives.

Or again, if we compare the average death-rate from the seven principal zymotic diseases for the same periods, I find that the reduction in round numbers represents an annual saving of 30,000 lives.

All this I admit is very gratifying, but it is when comparison is made between the death-audits of districts in which the Sanitary Acts are intelligently and conscientiously carried out, and

those of districts in which they are still practically ignored, that we can appreciate still more fully the enormous saving of life and prevention of human suffering which yet await improved sanitation. But even in the healthiest rural districts, the abominations of foul privy cess-pits or deep midden ash-pits polluting the air and endangering wells are still far too plentiful, while leaky drains are a constantly recurring source of nuisance. And these dangers to health are unfortunately perpetuated in respect to new dwellings, because the great majority of rural districts possess no urban powers, and have therefore no control over the structural details of the dwellings themselves or of drains and closet-accommodation. It is true that the Public Health (Water) Act insists upon a proper water-supply, but so long as there are no by-laws to regulate those other important details, risks of nuisance and well-pollution will continue.

These are questions which sooner or later must force themselves on the attention of the newly constituted County Councils, but there are others of perhaps greater moment. For though I am very pleased to be able to say from my own experience and what I know of other districts, that in spite of legal defects and local shortcomings, sound sanitary progress has been made in many parts of the country, there is no disguising the fact that in the great majority of small urban and rural districts a do-nothing policy is still tolerated, if not encouraged. And this is mainly due to the fact that the unfair incidence in rating naturally enlists the opposition of farmers and others to any village schemes of drainage or water-supply from which they themselves derive no direct benefit.

Then, too, there is another great stumbling-block to sanitary progress in small urban and rural districts to which I would allude with all due deference. Sanitary officials are plentiful enough; indeed, there can be no question that the country is over-officered, but they are not always well-trained, and when well-trained they are not sufficiently protected for the full and fair discharge of their duties. The great majority of the sanitary inspectors are elected from year to year or for short terms, while with comparatively few exceptions the medical officers of health are still further hampered by the conditions involved in carrying on general medical practice. I know I am trenching on somewhat delicate ground in once more alluding to the relations of the medical profession to the policy of prevention, but I cannot help asserting that in small urban or rural districts medical officers of health who are in active general practice are heavily handicapped in the discharge of their duties. If, as in some cases, they endeavour to discharge them efficiently and without fear or favour, they run the risk of

coming into collision with some of their best patients, and in any case they cannot expect the cordial co-operation and support of their rivals in practice. They are generally paid to do little, and as a rule they do not feel bound to exceed the limits laid down by their salaries. This was abundantly proved by the reports of the special inspectors who were sent by the Local Government Board throughout the greater part of the country some two or three years ago to inquire into the state of preparation of various sanitary authorities against an invasion of cholera. I am proud to say there are many exceptions, but the exceptions prove the rule; and a zealous and conscientious officer always runs the risk, when the period of re-election comes round, of being relegated back to the sole charge of his patients. It should be remembered that on the medical officer of health depends in very large degree the motive power of sanitation, and for this purpose he should not only be well-trained, but he should be appointed over an area large enough to occupy his whole time, and be debarred from private practice. As to the question of cost, nothing is more certain than that the system under which the medical service of the country generally has been hitherto carried out exhibits an unnecessary waste of resources, and that a much smaller number of officials properly organised would do much larger and more effective work, and, in all probability, at considerably less cost to the ratepayers.

I have been induced to refer more particularly to these obstacles and difficulties connected with rural sanitation because public health progress in the larger towns, considering the enormous difficulties which had to be faced, has made much more rapid strides than in smaller towns and scattered country villages. But in towns and villages alike, though in villages far more than in towns, the policy of prevention must always depend in great measure upon the sanitary condition of the home and its surroundings; and this applies as much to the mansion as it does to the humbler dwelling, and often more so. When people move into other houses they are generally assured in the most explicit terms that the sanitary condition is in every respect most satisfactory, but how often does it happen that in a comparatively short time the doctor has to be called in for indefinite ailments, bad throats, or something worse? Cases of this description are so notoriously frequent that it should be laid down as a rule that every tenant in search of a house should have the sanitary condition carefully inquired into by some competent official, and any defects removed before he takes possession. In London, Edinburgh, and several other large towns, there are Sanitary Protection Associations, which under-

take to make such inspections, but it would, I think, be a wise economy on the part of sanitary authorities generally if they themselves should undertake this most necessary work by appointing their surveyors, or other properly trained officials, at fixed salaries, and charging fees on a fixed scale, which could be regulated according to rateable value—the fees, of course, to be handed over to the sanitary authorities. Such inspection should also be made to apply to all schools, whether public or private, to hotels, boarding houses, and lodging houses.

With regard to the public control of that other large group of diseases, namely, those depending on reckless dissemination of contagion, I need only refer in the briefest terms, because I am afraid I have already trespassed too much on your time and patience. But, briefly, the principles on which effective prevention must be based are timely information as regards all cases of dangerous infectious disease, and prompt isolation, either at the home of the patient, when that is possible, or in hospitals set apart for the purpose.

The Infectious Diseases (Notification) Act, which, as the President explained in his address of last evening, was so hurriedly rushed through its final clauses, at the close of the past session of Parliament, would doubtless ensure the first great desideratum of timely information if it were generally adopted throughout the country. But, unfortunately, it is only made compulsory in respect to the metropolis, and it is left to other sanitary authorities to adopt it or not as they choose. In all probability the Act will be adopted by all towns of any considerable size, but I very much fear that the great majority of small urban and rural authorities will quietly ignore its provisions so long as its adoption remains permissive. The Act to be productive of full national benefit ought to have been made compulsory throughout the whole country, for it is manifest that if only adopted here and there while it is rejected in contiguous districts, its usefulness as a preventive measure will be greatly curtailed, and its administration in many localities will be rendered unsound and invidious. But, as the President informed us last evening, it would have been impossible to pass the measure except in this permissive garb, and we can only hope that the pressure of public opinion, wherever the sense of public duty is lacking, will lead to its general adoption. At all events, I feel sure of this, that wherever the Act is adopted medical practitioners will loyally do their part in carrying out its provisions.

The other important desideratum of providing proper hospital accommodation has already been met, or is being met in almost all large towns, and in some rural districts, but in respect to

these, it would I think be a wise economy if County Councils were empowered to provide a portion of the initial outlay, and to combine districts for the purpose of erecting such hospitals. For it should be remembered that many of the most dangerous cases of infectious disease which crop up in rural districts, occur among the wandering population, among tramps, persons in canal boats, and caravan people, who do not belong to any particular district.

Such are some of the thoughts and convictions on this all-important subject which I have endeavoured in somewhat tangled fashion to lay before you, and if I have succeeded in making them yours as well as my own, they will on that account, I hope, be deemed all the more worthy of public attention. For the policy of prevention appeals to the sympathies, and demands the hearty co-operation of all classes, and more especially of the upper and middle, that they may help those of the lower who cannot yet help themselves. And if in this cathedral city I venture once more to enlist the services of the Church on our side, it is because as a medical officer of health of a large district, I know how warmly clergymen interest themselves in the care of the sick under their charge, and because I cannot forget the noble example of that Apostle of health, the late Canon Kingsley. I believe no man, whether clergyman or layman, did more in his day to popularise sanitary science, to render it a subject of constant discussion in the press and on the public platform, and to introduce the teaching of physiology and the laws of health, into our public and elementary schools. Thanks to him and other pioneers of public health progress, popular education in this direction is fast becoming a strong force on our side, and though sanitary legislation may continue faulty, and sanitary administration lax, advancing knowledge of health and its requirements will become more and more our mainstay in lessening man's physical difficulties and mitigating his sufferings. Such knowledge will surely grow until it permeates all classes, and the workman of the future will be as ready to strike against being cheated in health as he now strikes against being cheated in wages.

On "*The History and Results of Fifteen Years' Sanitation in the City of Worcester*," *by* W. STRANGE, M.D., Medical Officer of Health.

THE paper which I am now about to read to the Congress, and which, by the courtesy of the Council, has been placed first on the list, does not pretend to be a scientific one. It deals simply with the history of the sanitary work which has been in progress since the year 1873 in this city, and that chiefly from the point of view of medical hygiene, taking the dwelling-house as the unit in sanitary amelioration. I shall therefore not deal, except in very general terms, with the great questions of Main Drainage and Water Supply, knowing that in those important subjects you will be addressed, in the course of the Congress, by men much more able to do them justice than I can pretend to be. My object simply is to show what our Sanitary Authority, aided by its officers, one and all, have been able to accomplish with willing minds and a conscientious appreciation of their duties to the public.

Worcester, like most other towns in England, did not appoint a medical officer of health until the Act of 1872 rendered such appointment imperative. The person the authority appointed was myself, consequently I have had the work of sanitary amelioration, as regards my own department, in my own hands from that time to this. My qualifications for the appointment were the fact that I had assisted Dr., now Sir Lyon Playfair, in investigating the sanitary condition of some of the large towns in Lancashire under Mr. Chadwick's commission, and had written an "Address to the middle and working classes on the excessive sickness and mortality prevalent in large towns," in 1845. I may mention also, that I sketched out a scheme for the Sanitary Supervision of the whole Kingdom, some items of which are only now beginning to obtain adoption in some of the clauses of the County Councils Act. This sketch appeared in the *Medical Gazette* of 1846, and obtained the recognition of such old and tried sanitary reformers as the late Dr. Stewart, of London, Dr. Rumsey, of Cheltenham, and others. At the time of my appointment I was practising in this city and county as a physician, on the staff of our County Hospital and City Dispensary, and am so still. I may mention that I have never experienced the slightest friction between myself and my brother practitioners in the performance of my duties as

Medical Officer of Health, caused by the fact of my so practising; nor, indeed, I think I may say, from any other circumstance. On the contrary, I have always met with very cordial co-operation from them, especially in the matter of reporting cases of infectious disease, although at present they receive no remuneration for such reports, as they are not compelled by law to make them.

I have been furnished from the first with weekly returns of all deaths, and, for a short time, was supplied with copies of the Union Medical Officers' Reports of Sickness ; but, after a short trial, these latter returns were given up, the Health Committee not thinking them worth the sum paid for them.

I have had the support and co-operation, during the whole tenure of my office, of an active and intelligent Health Committee, with the same industrious and painstaking Chairman, and of a learned and vigilant Town-clerk as legal adviser. We have now, since the enlargement of the city boundary, two Nuisance Inspectors, one of whom devotes his time to a regular house-to-house inspection, whilst the other, the senior, supervises the general work of the office, attending to every case as it arises, and acting as the Executive Officer of the Health Committee. The population in 1881 was 33,201, and is now, with the enlarged area, about 43,000.

We have also, as my colleague, Dr. Horace Swete, as Public Analyst for the county and the city.

Worcester is an old city, dating from the time of the Romans, if not earlier. It was a walled town, and, therefore, compressed within narrow limits. Its poorer population was crowded in narrow courts and alleys, behind the dwellings of the more opulent classes, with little light and fresh air, and plenty of dirt and filth of all descriptions. Although, of course, some amelioration was made during the centuries before this, the sanitary condition of large parts of the city, twenty years ago, was about as bad as it could be. I, fortunately, possess a record of its condition at the time of the passing of the Act of 1866. We were, at that time, threatened with an epidemic of the cholera, not the first by any means which had attacked this city. A Vigilance Committee was appointed to examine into the real state of the city, and in a report written by myself and presented by that Committee to the Town Council, I find the following items :—"The visitors, who made a house-to-house inspection, discovered and reported over *one thousand nuisances ;* comprising dwellings overcrowded by two or even three families living in them ; overflowing privies and cess-pits of enormous size ; houses unconnected with any sewer, supplied with water from surface wells, in most cases polluted with sewage and

drainage; courts unpaved, unlighted, and unventilated; windows not made to open, and the interior of the dwellings filthy with the absorbed matters of years. Epidemics of zymotic disease are frequent; in one quarter alone scarlet fever was said to have carried off three hundred persons; and the report goes on to say, that epidemics which are intensified, if not caused, by accumulations of filth, and the use of polluted water, strike hard when they visit this city. That typhoid fever is *endemic* in Worcester, and is clearly caused by foul drains and privies, and the use of polluted well-water." The death-rate at that time ranged from 26 to 27 per 1,000 or thereabouts. At the time of my taking office, in 1873, it was 25·5.

The first proceeding to be taken was naturally that of obtaining information. A house-to-house survey was made, by which notice was taken of the numbers living in each house; the numbers living in courts and alleys; the condition of the dwellings as regards cleanliness and waterproof; of the drainage and water supply; of the soil, paving, etc., of streets and courts; and other similar facts, such as privies, W.C.'s., and cess-pits.

As a short summary of the condition of the population discovered by this survey, I may state that the number living in courts was 3,145, occupying only 1,656 sleeping rooms, many of them containing more than one family—911 families living in 441 houses. The inmates of 466 houses used water from superficial wells situate on these premises. 1847 common privies, with their immense and foul pits, supplied the wants of the courts, alleys, and other crowded parts of the city. Many of these privies did duty for the inmates of three houses, or from twenty to thirty individuals each. There was no regular removal of the contents of these pits, which were emptied only when they became unbearable, and when the farmers could find time to send their carts for them. The streets were badly paved, and the soil in the lower and closer parts of the town was almost always damp and polluted with foul organic matters. To the credit side of the account must be placed the recent supply, complete and constant, of good water from the river Severn—a new system of sewers, which has since been extended to every part of the city, and the connection of the house drains with the sewers was being rapidly carried forward. There was also one Inspector of Nuisances.

The recommendations which I made to the Sanitary Authority as the outcome of this enquiry, were nine in number, namely:—

1. The improvement of the courts and alleys (where these could not be abandoned), and other crowded places by every practicable means.

2. The closing of such houses as were unfit for habitation, and the compulsory repair of others.

3. The compulsory drainage of every house into the City sewers.

4. The provision of tap (or Severn) water to every house at present supplied by well, and the closing of that well, in case it can be shown that the water in it is impure, and likely to continue so.

5. The regular and efficient supply and care of gullies and ventilators in the sewers, and the connection of all house drains with the sewers.

6. The enforcement of the law against overcrowding.

7. The improvement and alteration of the system of privy accommodation, both as to structure and number.

8. The institution of a system of cleansing all privies and cess-pits, so as to insure the rapid and frequent removal of their contents by the Sanitary authority itself, and the encouragement, especially in new buildings, of the erection of water closets.

9. The erection of a mortuary and post-mortem room.

This report was dated August 19th, 1874.

10. The providing a suitable Hospital for infectious cases, by fitting up a large house which had been previously used as a small-pox hospital, and which has proved admirably suited to the purpose, was recommended by me and agreed to immediately after the adoption of the above report.

If I have wearied my audience with these preliminary details, my excuse must be that I have wished to show how easily all the worst sanitary evils may be remedied, and an unwholesome and dirty town made clean, healthy, and pleasant to live in, by the enforcement of the law, steadily, incessantly, with tact, and in some cases forbearance, by the authorities, and by vigilant and active sanitary officers.

The first necessity for health in a population is a plentiful supply of good water. Our earlier fathers knew this fact well, and never built a house without first securing good water. It was the reckless and rapid building in all manner of places, careless of any other condition, so that the dwellings were placed near enough to the places of work, which culminated about the middle of this century in large towns, or parts of towns, where this and almost every other sanitary necessity were totally neglected and passed over. The next necessity is proper and sufficient drainage.

With these two prime requisites to hand, the problem of

converting Worcester from a malodorous, dirty, and unhealthy city, to one sweet, clean, and salubrious, was one to be solved *ambulando*. Constant inspection, immediate removal of nuisances, frequent cleansing, abolition of cess-pits, &c., enforcing the law against overcrowding, and the education of the people upon such points as ventilation of bedrooms, cleansing of walls and ceilings, washing of back yards and courts, and attention to defects in privies and water-closets, was the first work taken in hand.

My duties at this time were to act as an inspector chiefly, making myself acquainted with the condition of the interior of every house where insanitary conditions were likely to exist; insisting upon the duty of the *tenant* and not the landlord to keep the interior clean and whitewashed, as well as compelling landlords, by a slight straining of the law, perhaps, at that time, to keep the walls, roofs, and pavings of the houses and yards in good repair. As the result of this inspection, there is scarcely a house in the poorer parts of the city which has not been overhauled by myself, and some of the worst and most dilapidated have been attended to several times over.

As regards ventilation of houses, &c., I gave lectures in the schoolrooms, which were well attended, and some decided improvement was observable afterwards.

Owners and builders, although they scarcely ever resisted the law, were slow in seeing their advantages in these improvements. But the extensive migration of the better part of the working classes to the suburbs, abandoning their crowded hovels in courts and alleys, which set in at this time as the result partly of a rising desire for better things, and partly to obtain better air for their children, opened their eyes to their real interests. The horrible nuisance of the immense privies and cess-pits was next attacked, and by slow degrees at first, quickening afterwards, we made the people ashamed of these common latrines, and all their filthy and indecent accompaniments. At first little way was made in this respect, on account of a pending injunction against us by the towns lower down the river, who accused us of polluting the river from which they, as well as we, drew their supply of drinking water. It is a nasty and disgusting thing for any town, or even house, to do, to throw all its slops, refuse, and ordure into a stream from which human beings habitually drink. This, however, we did, and are still doing, awaiting the time when experts shall have agreed upon the best mode of disposal of these matters without creating a greater nuisance than the one they propose to abate.

We took heart, however, when we were assured by eminent

chemists that all the dangerous elements of our sewage disappeared by oxidation before it had passed sufficiently far along the stream to reach our next neighbours! I am not chemist enough to decide whether or no this dictum is entirely reliable. But, whether it be so or not, the idea of drinking even *converted* sewage is still disgusting and offensive to all sensitive people; and therefore the sanitary authority of Worcester is exceedingly exercised in its mind upon this subject at the present moment. I think that the authority would rejoice if, as the outcome of all our labour and interest in forwarding the success of this Congress, some of the learned gentlemen who listen to this our cry for help, would help us out of this "slough of despond" by successfully solving the riddle I have just stated. Charity begins at home, and what many people are waiting to be assured of is, whether we can so dispose of our sewage otherwise than by throwing it into the river (a sewage farm being a great *crux*) without doing as much violence to the health, and the feelings of our own inhabitants, as we are now doing to those of our neighbours. We are bound to grapple with this subject *at once*, under promise to the Local Government Board. Plans have been obtained, and different modes of sewage disposal have been well discussed; and still we are awaiting the advent of the Hercules who shall cleanse our Augean stable.

With regard to our water supply, it is and has been for many years constant and abundant in quantity. It is filtered, and every house is, or may be, supplied with it at the very moderate cost of 5d. per 1,000 gallons. Nevertheless, being drawn from the river Severn, it is open to the charge of being more or less polluted by the drainage of many towns, fields, and farm-yards. With regard to the possibility of removing or neutralizing these noxious matters, opinions, as you are aware, differ.

Pending the adjustment of scientific opinion on this point, we have lately cast about to see if a purer water could not be obtained than that derived from the Severn. Amongst the Lickey Hills, between here and Birmingham, water is obtained from artesian wells of the very purest quality, and we have discussed the question of substituting this water, in whole or in part, for that of the river Severn.

The principal point to be decided in going to the Lickey Hills, was whether the supply would be sufficiently abundant and permanent. With regard to the latter, nothing but a prolonged experiment would satisfy any scientific person on this point. Our authority, at the present moment, is not disposed to run the risk of failure in these two respects, even if the cost and terms could be made agreeable. They seem resolved to continue the use of the Severn water, with a

determination, I believe, and hope, of using the best mode of filtration obtainable, and to provide additional storage room, so as to dispense with the necessity of daily pumping in time of flood.

You will doubtless say, alas for the inhabitants of the towns below you! But we really intend to grapple with both questions, viz., that of sewage disposal, so as not to create a nuisance to ourselves or neighbours; and that of purification of the Severn, and of the water we use.

Our main drainage, begun 35 years ago, is now carried into every street; and every house-drain, with a very few exceptions, is connected with a sewer. In some places, owing to the almost dead level on which parts of the city are built, there is not sufficient fall. This evil, however, time and experience have taught us to remedy by extra flushing. Flushing-tanks have been placed at the head of nearly every sewer, and at many junctions, and others are added at any spot which seems to require them.

The greatest benefit can be traced to this extension of flushing, scarcely any complaint now being made of bad smells from the street ventilators. It remains now only to cause the house-drains to pass their contents into the sewers more rapidly and effectually than, in many cases, they do at present. For, as you will admit, this last item of drainage is a most important one. Ventilation of the sewers into the streets can do no harm if the contents of the sewers are not allowed to decompose. But blocked house-drains, and the consequent return of gases into the closets, bath-rooms, and kitchens, of dwelling-houses, are, in my experience, the most frequent cause of typhoid, diphtheria, diarrhœa, sore throat, or other cognate forms of disease that we have to contend with.

To entirely prevent this evil is almost impossible; for ruptures, subsidences, or blocking of drains are of daily occurrence, and require all the vigilance of the inspector. Next to seeing that house-drains are well laid and properly connected, the first object is to get all the water available passed into them. Hence, I am against the small cisterns, holding only two gallons or so, which builders are now placing in the water-closets of our cottages. This quantity, often let down at a dribble, will not remove hardened solid masses, especially when mixed with cloth, hair, wood, and other substances which children and careless women throw into drains. I consider the existence of any kind of trap *within* a *small* dwelling to be a nuisance of itself, and certain, sooner or later, to cause mischief. The only safety of the poor from being decimated by typhoid and its allied diseases, is the fact that all their closets are out of doors. Accordingly, we have declared every sink and trap,

indoors, to be a recurring nuisance, and have cleared them away almost entirely.

In most old houses, and all new ones, sinks now discharge on to gratings out of doors. The down-cast water pipes, which were formerly almost universally led directly into the house-drains, are also made to discharge in the open, as well as pipes from baths, &c. The only danger of sewer gas in a dwelling now remaining to us is the existence of water-closets and their pipes in the better class of houses. Defects in these are continually occurring, and generally no notice is taken until a case of typhoid calls for the inspector. Happy are the inmates of a house where there is no water-closet at all; or, at all events, in proximity to bed or living rooms. All such as exist should be strictly cut off from the dwelling, and ventilated, and ventilating only into the outer air.

One of the most valuable adjuncts to good sanitation is the possession of a hospital for the reception of cases of zymotic disease. Without this it is useless to struggle against the spread of these diseases, or to hope to prevent their germs being sown broadcast amongst the population. And I cannot understand how so many large towns have got on all these years without such a prime necessity. Of what use is a law for compulsorily reporting cases of infectious disease, if there be no place to isolate them in, when reported and discovered? As to giving advice to the mothers not to allow their infected children to mix with others, or to keep them from school until danger of infection is past, it is utterly useless. We seek to get hold of all first cases of scarlet fever and of measles as quickly as possible; and, as we make no charge for maintenance, we meet with practically no resistance; indeed, so popular has our Infectious Hospital become that application for admission is made to us in many of these cases immediately by the parents themselves.

One of the greatest advantages which the hospital affords is the reception of cases of typhoid fever. Typhoid is a disease which depends, for the recovery of the sufferer from it, almost entirely upon the nursing. Early, constant, judicious, and effective nursing is the cure *par excellence* for typhoid. Our success in this particular has amazed myself. For the last three years we have not had a death from typhoid in our hospital out of 36 cases, except those of two infants moribund when brought to the hospital. So skilful is our hospital nurse, that I could safely leave a patient, after the first two or three days, to her really tender mercies. No expense has ever been begrudged by our authority to make our hospital efficient, and our County Hospital now sends its infectious cases to it.

The present condition of our city then, you will well believe,

offers a striking contrast to what it did in the year 1866, or even in 1872. We have cleansed and dried the soil by paving the courts and backyards, and by the abolition of cess-pits; by good house and privy drainage; by the substitution, almost universal now, of water-closets for the old-fashioned privies; and by the paving of most of the streets with granolithic pavement. We have an ample supply of river water, and have abolished nearly every well in the city; we have improved the air of dwellings by removing sinks and traps to the outside, and also by cutting off the rain-water pipes from the drains. To these measures may be added the endeavour to prevent the decomposition of sewage in the main sewers, by efficient flushing. With regard to house-drains in cottage property, I have come to the conclusion that the syphon placed between the closet or yard and the junction with the main sewer, is a mistake. They are constantly becoming partially or wholly blocked by things thrown down the drains, and thus the closets and drains become choked, and danger immediately ensues.

It is only right to say that several new influences have been at work during the last ten or twelve years, tending to the lessening of the amount of disease and the tendency to death, amongst the population of Worcester. Two of these, the Provident Dispensary and the Nursing Institution, have certainly contributed largely to the reduction of the death-rate amongst the poorer classes. Any poor person can now obtain the services of a trained nurse, free of charge.

I am aware that I have now exhausted the time allotted to me. I am anxious, however, with your kind indulgence, in a very few words, to tell you what effect our sanitation has had upon the health, comfort, and lives of the inhabitants. At the beginning, in the year 1872, the death-rate was 25·5. Last year it was 18·74, or a reduction of nearly seven per 1,000, on a population of 43,000, a saving of *three hundred* lives per annum. This year, up to date, the rate is only 14·5, and every year holds out a prospect of still further reduction.

But of more consequence than the death-rate, which is still kept too high by the abnormal deaths of infants, is the improvement in the general health of the population. Not only do we never see persons scarred with the foul marks of small-pox, but cases of scrofula, rickets, diseases of joints, and phthisis pulmonalis have greatly declined, both in number and severity. Rheumatism, which was once a famous Worcester complaint, is also much more rare. But it is in respect of zymotic diseases that our sanitary efforts have borne the most fruit. I have already told you that on one occasion an epidemic of scarlet fever carried off three hundred persons in this city. We no

longer fear an epidemic of scarlet fever. Typhoid fever, which was said in the report of 1868 to be endemic in Worcester, has been so reduced in severity, as to enable me to make the statement in regard to our hospital, which I did a few minutes ago. And as regards numbers, the tables at the end of this paper will show a corresponding reduction.

A disease strongly marking the condition of the sanitary work in a town is said to be the summer diarrhœa of children. I cannot give you exact figures in this category before the year 1874, but I remember the time when the diarrhœa of children was a formidable item in the mortality. Now, in most years, it gives us no trouble at all. And I think I am not wrong in making the statement that most diathetic diseases have been robbed of great part of their severity by the more wholesome conditions which now surround the patient.

I have drawn up a table showing the progress made in diminishing, first, the general death-rate, and second, the zymotic death-rate, for the years 1874 to 1888. As I have already hinted, sanitary improvement in Worcester has not been by leaps and bounds, but steadily progressive. At first somewhat tentative, it became more active as we found public opinion keeping pace with us. For the first four or five years but little impression was made upon the death-rate. Then, in 1879, a start was made which has gone on increasing until the present moment. And I think I can trace each item of improvement as the direct outcome of some progress in our sanitary action. Thus, the removal of privies and cess-pits, which went on slowly at first, became much more active in 1879-80, and about this time also, the authority undertook the cleansing of such places as remained. Hundreds of these filthy structures were cleared away, and the pits filled up, and now but few of them remain. In connection with this, note the extraordinary drop in the mortality from scarlet fever and measles which occurred in 1879. In the years 1875-8, we had an average of 52 deaths from these two zymotics. In those of 1879-85, it drops to 17 in the year. Then an addition of some 10,000 is made to the population living in undrained or badly drained districts, all with privies and cesspits, and the average number reaches to 23, but now, this year, when the drainage and water supply of the new districts is nearly complete, we have, so far, only 2 deaths from these diseases!

The course of typhoid fever has not been quite so favourable. It would appear, at first sight, that the number of deaths from typhoid has been singularly uniform all along. Not so, however. The first seven years give an average of 13 deaths. Then, in 1884, we had a sudden outbreak of the disease, consequent

upon the pollution of the Severn by the sewage of Kidderminster, where, at the time, an epidemic of typhoid was raging. There were 31 deaths from this cause in the course of the Autumn and Spring of 1883-4. Since this time, a great fall in the numbers has taken place, and in the last three years, the average number of deaths, allowing for increase of population, would have been, when compared with former gains, only 9.

But the most interesting thing to be noted in regard to typhoid is the extraordinary mildness of the cases of late years. Amongst patients removed to our hospital, there was not a single death, in three years, with the exception of the two moribund infants before referred to! Instead of diarrhœa, hæmorrhage, &c., we have constipation, with scarcely any intestinal symptoms, and few or no spots.

In connection with these facts, we shall find the same condition of things in the case of the summer diarrhœa of infants. In the years 1874-8 before the abolition of privies, and the drying of the soil by paving the courts, alleys, and back-yards of houses, the average number of deaths was 53. In the next 4 years, it was 36, and in the next 3 years, after the addition to the population, if reduced to the same ratio as before, it would have been 24 only. This year, the number has been 18, or at the former ratio, only 14, half of which occurred in the winter, and therefore bore no distinct relation to ordinary summer diarrhœa.

The most unsatisfactory thing about our death-rate is the great mortality amongst infants under 1 year of age. In this one respect we are behind most of the towns situate similarly to ourselves, and it has caused us much anxiety to find a remedy for it. The time at my disposal does not admit of my going into this subject at the close of my paper. I will illustrate it simply by contrast. I take the deaths of the present quarter of this confessedly very healthy year. Out of 123 deaths there were under 1 year of age, 39; and under 5, 8; 5 and under 15, 4; 15 and under 25, 8; 25 and under 60, 28; over 60, 46; of which last 17 were over 70, and 10 over 80 years of age; thus leaving 48 only as dying between 1 and 60 years of age. Therefore, barring excessive mortality of infants, which, however, we have seen is not due to summer diarrhœa, may not this city be congratulated on the great strides it has made in true sanitary work, resulting in the improved health and comfort of its inhabitants, in the freedom of its youth and manhood from fatal diseases; and especially on the fact that old age—60, 70, 80, and even 90 years, is reached by one-third of all the inhabitants.

Table

Showing the Death Rates, Zymotic Rates, and total number of Deaths from Zymotic (or Infectious) Diseases, in the Years 1874–1889.

Years.	Death Rate.	Zymotic Rate.	Actual Number of Zymotics.	
1874	22·30	3·0	95	1st Period. Average General Rate 24·3. Average Zymotic Rate 3·9.
1875	25·58	4·2	135	
1876	23·37	4·2	134	
1877	24·45	4·6	150	
1878	24·45	3·6	116	
1879	21·17	1·4	45	2nd Period. Average General Rate 20·64. Average Zymotic Rate 2·14.
1880	20·90	3·4	109	
1881	20·60	2·26	77	
1882	19·73	2·55	86	
1883	21·00	1·7	58	
1884	20·90	1·7	59	
1885	20·22	2·0	69	
1886	21·85	1·83	79	3rd Period. Average General Rate 20·53. Average Zymotic Rate 1·88.
1887	21·00	1·83	79	
1888	18·74	1·9	83	
1889	14.50	0·79	29	
To Sept. 24, Estimated to Dec. 31.	16·30			

Appendix.

Some years ago the Town Council requested me to furnish them with the death-rate of the city forty years ago, and since. I was unable to comply with this request owing to the absence of the necessary documents. I have lately been furnished with the Supplement to the Thirty-fifth Annual Report of the Registrar-General, which contains the information required to answer the question put to me by the Town Council.

Table 1, following, shows the Annual death-rate of the city in the three decennia, 1841–50; 1851–60; 1861–70.

Table 2 gives the exact number of deaths from the several Zymotic, or infectious diseases, in the ten years, 1861–70; that is the years immediately preceding the passing of the Public Health Act of 1872. A comparison of these numbers with those given in the tables above, showing the deaths from the same causes during the last fifteen years, will speak for itself, and will require no comment.

Table I.

Extracts from the Supplement to the Thirty-fifth Annual Report of the Registrar-General, published in 1875.

Average Annual Death Rate, 1841–70.

10 Years from 1841–50	10 Years from 1851–60	10 Years from 1861–70	Mean of 30 Years
24	23	25	24

Average Annual Death Rate from Zymotic diseases in the years 1861-70, 5·39.

Table II.

Total Deaths in the 10 *years*, 1861–70, *from the following Zymotic diseases.*

Population: Males, 15026; *Females*, 16667; *Total*, 31693.

Disease	Males	Females	Total	Average per Ann.
Small-pox	41	28	69	6·9
Measles	58	71	129	12·9
Scarlet Fever	209	195	404	40·4
Diphtheria	18	25	43	4·3
Whooping Cough ..	65	67	132	13·2
Fevers, chiefly Typhoid ..	232	218	450	45·0
Diarrhœa and Cholera ..	243	251	494	48·4
Totals	866	855	1721	172·1
Total of all Deaths in the 10 years	4040	3804	7844	784·4

Average Death Rate of 10 years, 24·74.

Mr. Washington Lyon (London) said he noticed that Dr. Strange said there was no death from small-pox. Might he ask, was vaccination universal in Worcester? Did that account for it?

Dr. A. Carpenter (Croydon) said that it reflected considerable credit on the Mayor and Corporation to have secured the services of Dr. Strange for their medical officer, because he had carried out his work according to what he had contended in his paper to be the first duty of a Medical Officer of Health, namely, to recognise that the foundation and the unit of sanitary work was the individual house. It was requisite for the purpose of carrying out sanitary work properly, to pay particular attention to the individual house. If a medical officer did not do that it was not likely he would succeed in the work he had undertaken. Dr. Strange had proved to him in his remarks conclusively, that he understood what he had to do, and that he had done it thoroughly, because it was only by getting that information that he was able to grapple with the difficulties that were likely to arise in dealing with sanitary matters among the people. There was another point in Dr. Strange's paper which struck him with considerable force, and that was the reference to the efforts that were being made by the Corporation under his direction for the exclusion from the houses of all communication with the sewers. Evidence which had been obtained of the effect of the exclusion specially from the houses of the working classes, showed it had an important bearing on the health of the district. He could not help but think a source of considerable amount of the success which had attended Dr. Strange's efforts in Worcester, was due to that fact; because where there was no connection between the sewer and the interior of the house, the prevention of a certain amount of contamination from that source, had shown itself in a diminished zymotic rate. Then Dr. Strange referred to the difficulties that were involved in the work of constructing sewers. That was an extraordinary difficulty it was true, and until it became positive law on the part of the local authority, that no sewer should be laid underground that was not put down on a solid basis—on a concrete foundation—so that there would be no fall of the sewer and no consequent leakage of any kind or sort, they would never get rid of that difficulty in connection with the construction of house-drains. If this course had not been adopted in Worcester, he would strongly urge upon the local authority the adoption of a bye-law requiring that no single drain should be constructed, except on a solid bottom, and they must be careful to keep the roots of trees away from the line of pipes. There was another point in the paper with regard to the conditions of the dwellings of the poor. His observation, which had been very cursory of the poor of the district, told him to infer, from the appearance of the people, that there was a great want of ventilation in the interior of their dwellings. That was a point to which a certain amount of attention should be paid, for the purpose of getting rid of some of those tendencies which were manifest among the poor, arising from the want of fresh air. The aspect of the

children in the streets was more anæmic than he liked to see, but, at the same time, he congratulated the Corporation and citizens of Worcester on the results which had followed the application of sanitary laws in the district.

The Mayor of Worcester* said the question as to the desirability of not pouring the contents of the sewers into the Severn had been raised. As a principle he did not think anyone could deny that it was correct. But at the same time they maintained that they were doing no particular harm. He thought the death-rate in the returns from the last report of the Medical Officer of Health, 14 per 1000, was not very serious. The proper course, if they wished to ensure the purity of streams and rivers was to begin at the fountain head and work down. It would be of very little value for Worcester to arrange for the disposal of its sewage by precipitation or irrigation, assuming that a large amount of pollution was taking place higher up the river in Wales, at Shrewsbury, and other places. He entirely agreed with remarks that had been made as to the great value of the disconnection of all house-drains from the main sewers. That disconnection should be two-fold—first by water traps, and secondly by air traps. Where possible he would recommend strongly that the traps should be duplicated. The air traps should certainly be duplicated, and if possible the water traps, so that if the pressure of sewer gas were considerable it would meet with two obstacles to its progress into a house, and thereby a double security would be afforded. In Worcester there had been complaints about disagreeable smells arising from the street gratings of sewers; wherever it was possible ventilating shafts had been erected. They found a great difficulty in obtaining permission to erect these shafts, many people said it was very objectionable to have the smell as they passed along the streets. But he maintained it was much more objectionable to have the sewer gas filtering through the houses. In the streets the gases mixed with large volumes of air and were rendered less hurtful. As the pipes in a house became affected by the increased temperature through heating, unless they were properly trapped the warm air of the house attracted all the sewer gases into the house; so that the higher the temperature of the house the larger the escape and volume of sewage gases. They would be glad to receive suggestions from members present with regard to the proposed sewage works for the city. They thought in the particular case of Worcester precipitation was by far the best system, looking at its situation and certain local circumstances; possibly a small piece of land in addition might be used for irrigation purposes or passing off the effluent. He was hoping they might have heard some discussion of the electrical process of precipitation.

Dr H. Swete (Worcester) said, in answer to the remarks of the last speaker, that though the pollution of the river Severn above

* Mr. Alderman Ernest Day.

Worcester was a serious matter to that city, especially when the sewage of Kidderminster was occasionally poured into it, yet he considered that there was not that danger to the towns *below* Worcester. At a time when an epidemic of typhoid was raging in Kidderminster the inhabitants of Worcester were for three days in terrible danger through the whole of the sewage of Kidderminster being allowed through an inadvertence to flow into the river. It was a curious fact, derived not only from his own analysis but from those of other chemists more eminent than himself, that the sewage of Worcester, a city with 44,000 inhabitants, with its manufactories, could not be detected at Tewkesbury, sixteen miles further down the river. He attributed this to the dilution and oxidation of the waters of the Teme, a river that was only polluted by the small towns of Knighton, Malow, and Tenbury, or, as some people thought, by the underground springs in the river and vegetable and animal organisms feeding on the sewage. He considered that the supply of water to Worcester should therefore be taken from the Teme and not from the Severn, although personally he hoped the day would soon come when sewage would not be allowed to enter the Severn at all.

Dr. W. Strange (Worcester), replying, said, in answer to Mr. Washington Lyon, some time ago he examined every child in the public schools in Worcester. He proposed to do it again to see whether vaccination had been carried out, and he found that 95 per cent. of the children had been vaccinated. He thought that Authorities were quite alive to the necessity of proper vaccination. He was quite sure the Local Authorities would decide how they would deal with the question of sewage as quickly as possible. The hospital which had been referred to was a private house, in which about ten rooms were available, so that they could divide the sexes, and the children from the adults. They could divide the house between two diseases such as scarlet fever and typhoid. They had one or two cases where persons had gone in afflicted with one disease, and had taken another. However, nothing serious had occurred from it. It was impossible in one building to avoid the risk of nurses taking a disease from one ward to another. When they had had typhoid and scarlet fever in the house at the same time they separated them as far as possible, dividing the nursing staff. It had been asked why they continued to pour the diseased germs of Worcester into the river. It was simply through an accident in the first instance, which resulted in the sewage finding its way into the Kidderminster water, which produced the epidemic of typhoid there ; and when an effort was made to correct that, they made another mistake and poured the typhoid germs into the river for two or three days. To show what the effect of that was, they had in the close of the autumn and in the succeeding winter and spring a large number of typhoid cases, which he had no doubt resulted from the transmission of the germs by the river. If it was asked why the epidemic continued in Worcester during the winter and the spring, he could only attribute it to the faulty system of filtering which caught and held the diseased germs.

This was a danger which always threatened them in filtering. He would beg to be excused answering the question of Mr. White as to precipitation. He did not treat upon it. The Mayor of Worcester had kindly assisted him in answering some of the questions put to him. He hoped the Mayor would excuse him for saying that Local Authorities would not be doing their duty until they grappled with the sewage disposal question, and took out all the bad materials now going into the Severn. He was sorry to differ from Dr. Swete, but he did decidedly differ from him as to the sewage. If the water at Tewkesbury were better than at Worcester after receiving the drainage of 50,000 or 60,000 people, then the pollution of rivers was the best thing they could possibly have. It might be well to go and live at Tewkesbury, and enjoy the stuff the Worcester people threw into the river. It was no argument to say, what was the use of Worcester diverting the sewage of the city from the Severn while pollution was going on higher up the river by towns in Wales. Worcester was the largest city on the river Severn. Why, then, should they not set the example? If they were to set to work, the towns above them, Kidderminster, Shrewsbury, and Welshpool, must be ashamed of themselves if they did not follow the example.

On "The Sanitary Aspects of the Pottery Manufacture," by JOHN T. ARLIDGE, M.D. and A.B.Lond.

IT may be asserted of every manufacture and trade, that it presents more or fewer features peculiar to itself, which affect, in a greater or less degree, the health of those engaged in it.

This fact is indisputable, but it has not arrested the attention of sanitarians as it ought to have done. It has, on the part of medical men, led to few researches concerning the consequences attendant upon the pursuit of different occupations, or the causes producing them, and yet these latter are as patent when looked for as any disease-producing factors known to the profession.

These prefatory observations might be readily, and not unprofitably extended, but the limit of twenty minutes allotted to a communication by the rules of the association, enforces their curtailment, and I will at once proceed to sketch the sanitary aspects of the Pottery manufacture, as I have had the honour of being asked to do by the Council of the Sanitary Institute.

Now it so happens that Potters as a class of artisans are remarkable for a high mortality, a circumstance which, of itself should challenge inquiry in order to ascertain the cause. And when inquiry is started, we encounter at once numerous questions for solution, both by medical men and by sanitarians. The former are called upon to specially study the disorders attendant upon the occupation, and the latter to investigate by what sanitary measures the occurrence of those disorders may be best met. At the threshold of their investigations they will perceive that they have, in the industry under consideration, to deal with many different branches differing among themselves in the matter of causation of disease, and in that of the health conditions to be rectified, as much almost as any distinctly marked trades do from each other.

However, three primary divisions may be readily distinguished: 1, the branch occupied in the making of ware from the clay; 2, that concerned in glazing and firing it; and 3, that devoted to its ornamentation, by painting, gilding, and printing. The last named department is known as the decorating or finishing division; whilst the first mentioned is pre-eminently the occupation of Potters properly so called. The second branch is intermediate between these two, including processes appertaining to each, in the hands of workmen known as oven- and kiln-men, and as dippers and placers.

These primary divisions of the pottery manufacture are themselves separable into subsidiary sections, presenting sanitary conditions of very varied character. To enumerate these secondary branches, and to note the peculiar health relations of each, would carry me far beyond the compass of this present paper.

I propose to treat my subject under three heads, viz.:

1. The materials employed;
2. The processes of the manufacture; and
3. The circumstances incidental to it; that is, those which affect the health of the artisans, but are non-essential to the industry.

And first, as to *the materials employed*, regarded from a sanitary point of view, it goes without saying that the "clay," out of which all ware—whether china or earthenware—is formed, ranks first in importance.

In remote ages potters' clay was clay in the ordinary acceptation of the word, or a natural aluminous compound from sedimentary deposits. But such is not the clay now used in the potteries; some of like kind, indeed, brought from Dorsetshire, enters as a component of the fictile material worked up. But the more important constituents are the so-called Cornish clay and stone imported from Cornwall.

These substances consist of decomposed granite. The clay is prepared by many washings and prolonged exposure to the air, whereby it acquires great whiteness, and is easily reducible to fine powder. As may be inferred from its origin, the proportion of alumina in it is small as compared with the contained silica. Here, then, we find potters subjected to a silicious material, which, in the process of manufacture, largely escapes as dust, and permeates the air they have to breathe.

The several clays in use differ in quality, and in the preparation of the basic material, technically styled "the body," out of which the future ware is to be fashioned, these are mixed together, in proportions differing with the different views and purposes of manufacturers. So it happens that some "bodies" are more silicious than others; as happens with the material used in making the special ware called "granite."

This being the case, we can understand that some clay compounds will prove more injurious to workmen than others. Moreover, there are wide variations in the degree of exposure to dust, depending upon the character of the work followed by different hands.

The principal sufferers from dust are the potters, properly so called, to wit, the *throwers*, who work with the well-known and most venerable machine, the potter's wheel; the *pressers*, who are distinguished as "flat" or "hollow ware" pressers, according to the character of the articles they manufacture; the "turners," who, by means of an ordinary lathe, give smoothness to the surfaces and edges of the ware as it comes to them from the pressers.

In the case of flat ware—plates and cups,—a plan of giving smoothness to the surface has of recent years been introduced, under the name of "*towing;*" the process consisting in holding with sufficient firmness a piece of tow on the surface, whilst the article operated upon is rotated on a small turn-table with great velocity. This proceeding, I hardly need remark, is attended by the copious evolution of dust.

Subordinate departments of the potter's art are represented by the occupation of fixing on cups, tea-pots, or other hollow ware, the handles and spouts. This makes the business of "*handlers*."

All these workpeople in pursuing their special craft give origin to more or less dust which floats in the air around them, settles on their clothes and every object in their workshops, and gets drawn by inspiration within the bronchial tubes, and, in time, finds its way into the lung tissue itself.

The pottery manufacture, therefore, is distinctly of an insanitary nature by reason of its dust-producing conditions; and

it becomes the duty of the sanitarian to devise measures to lessen those conditions, and to obviate their activity in provoking lung disease.

Another material that finds a place in the making of pottery is *flint*. The flints used are derived from the shingle on the northern shores of France, or from the deposits, occurring in strata, in our own chalk hills. For the use of the potter they are calcined and then very finely ground into a light white powder. Prepared flint enters into the composition of the clay body, and is used also largely in the china business, to surround the cups and saucers, or other porcelain articles, when placed in the boxes—technically called "saggars,"—in which they are to be "fired."

The addition of flint to the clay "body" necessarily implies an aggravation of the evils following upon the inhalation of the dust; and with regard to the men engaged in "placing" the ware in the saggars, we at once see how seriously they are exposed to breathing the flint powder. The like exposure again attends them when, after its firing, the ware has to be removed from the saggars.

But the operation of flint as an element of disease does not cease with the last-named act. Some of that substance adheres so intimately to the china that it requires to be brushed and beaten off;—a most health-destroying business pursued by women, call "*scourers.*" As may be surmised, such work-women are recruited from a class of a more or less necessitous grade, whose aim is to earn wages rather than to prolong life.

The sanitary ills of the potter's trade are unfortunately increased by yet another material. I refer to the metal lead, which is largely used, in the form of the carbonate and of litharge, to make the "glaze" that gives lustre and smoothness to ware, and renders it impervious to moisture. It likewise enters into the composition of many colours used for the purpose of decoration. To make the history of lead complete I must advert to another potter's material, viz., borax. This is innocent enough in itself, but it occurs in very bad company; that is, with the salts of lead just now mentioned. Borax has excellent chemical properties, fusing with metallic oxides and earths to make a glass-like substance. The possession of these properties brings it into use in the pottery manufacture to form, upon fusion with the lead salts, some china clay, and occasionally other ingredients, a vitreous mass, which, after being finely ground and mixed with water, produces a thick milky fluid—the "glaze."

The business of glazing is very simple, consisting in plunging the ware into the glaze for a second, and then withdrawing it;

any excess taken up dropping off by gravitation, or else removed by a piece of sponge in the hands of an assistant. The process is termed "dipping," and the operator "the dipper." The porous ware absorbs superficially a coating of glaze, and when this is subjected to heat in a kiln, it becomes vitrified and intimately adherent to the surface in the form of an enamel.

To reach this condition it is necessary to pass, as I have intimated, the dipped ware through fire. With this end in view the several articles are arranged in saggars, just as in the case of those turned out of hand by the throwers and pressers, precedent to the first firing. The consequence is that another set of men, called "gloss placers," are brought into contact with the poisonous glaze, and often fall victims to it. But it is no uncommon circumstance for a man to pursue the double calling of oven-man and placer.

I just now alluded to lead salts as colouring agents. They serve also another purpose, viz., that of acting as a flux to other colours. The preparation and mixing of colours is consequently a business exposing those occupied with it to the dangers of lead. But the poisonous colours become a source of plumbism to a far wider circle of workpeople, viz., among the decorators of earthenware and china. Now and again those who paint with oil colours show the disease; but the most frequent sufferers are the majolica painters—mostly females,—who use colours more heavily charged with the metal, ground up with water, and laid on more roughly and thickly than in enamel painting.

Further, lead colours are often used in a dry state, prior to firing, being dusted on the surface to be coloured by a process known as "ground-laying." Here, consequently, the poisonous material is in a shape to facilitate its inhalation and swallowing, apart from its possible absorption by the skin.

What has been stated in respect to lead colours comprises the major part of the facts attaching to colouring materials, in general, with regard to their sanitary character. Other metallic colours are indeed in considerable use, for instance, cobalt and salts of gold, copper, and tin; but when no lead is present in combination no definite ill results are traceable to them:—for one reason that their employment is on a comparatively small scale. Arsenic forms very brilliant salts, but, happily for potters, it is volatilized by heat, and arsenical colours in consequence become destroyed. Yet, for some recondite reason or other, small quantities of this virulent poison are occasionally introduced in certain mixtures by some manufacturers and colour makers. Lastly, mercury has its uses, but mainly to make an amalgam with gold.

This brief review of materials used in the pottery manufacture

must suffice, and I pass on to consider the general sanitary conditions associated with the occupation. Of these, heat occupies the foremost place. The workshops of pressers—the most numerous class of workmen—become unduly heated by the necessary presence of the drying closets, placed close to the working bench for the sake of convenience. These closets are kept highly heated by hot pipes for the purpose of drying, to a certain extent, the newly-made clay utensils and the moulds upon which they are made. The closets, indeed, have swing doors, but these are so constantly opened by the lads called "mould-runners,"—who carry the ware with its mould from the presser as fast as it is made,—that they can only partially prevent hot air escaping into the shop.

We cannot fail to perceive in this state of things a cause of damage to health, super-added to the effects of dust, in the production of general muscular debility, with fatigue and sweating. At the same time the heat favours the development, and, by rarefying the air, also the inhalation of dust. A saving condition of placers' labour is that it is intermittent. Again, the printers in following their occupation, are exposed to a considerable temperature, for the press is highly heated, and close to it is the hot plate necessary to spreading the ink on the copper plates to be printed from. The printers are very few in number, but with them work many women, who rub the printed pattern on the ware, and are called "transferrers," and a still larger number of girls who are busied in roughly cutting out the patterns from thin paper on which they are printed, and who from this employment, are termed "paper cutters."

Lastly, other sufferers with heat are the men occupied about the ovens and kilns, in firing and tending them; and, when after some two or three days the baking or firing is completed, in withdrawing the contents. The work of oven-men does not impose constant nearness to their fires, and the greatest exposure attends the operation of oven-drawing, especially when there are urgent orders, and the ware is drawn whilst still very hot.

Heat is not alone operative, for there is beside it, exposure to strong currents of cold air, particularly in the case of ovens placed outside the main building of a factory. Hence, as might be surmised, the workmen in question are very liable to colds, and especially to local rheumatism.

The working appliances of a pottery are some of them not without possible effect on the health of the artizans. Where not done by steam power, the turning of the potter's wheel by hand is a laborious, though intermittent task, and usually performed by women. When there is strength for it, the work

presents no tangible cause of ill health, but unfortunately the strongest women are not those always selected.

The same thing may be asserted of "lathe treading," but in this occupation it is far too common to employ young girls about the age of puberty, to whom constant standing and jumping with one foot on the treddle of the lathe, is a too severe exertion for many, and productive of ill health.

The attitude of the workmen is also a sanitary incident to be noticed. In both throwing and pressing, the arms are brought to the sides whilst the chest is bent forward. In this circumstance we recognize a cause of narrow chest, imperfect expansion and inefficient filling of the lungs; at the same time one hand and arm, in the case of throwers, being more exercised, and this, too, at a different level to the other, we get uneven shoulders—one more raised than the other.

Another element contributory to depraved health is the sedentary nature of the occupation of many branches of the manufacture. We find this in the case of handlers, who put handles and spouts on the articles made, and in one or two minor operations. But it is seen on a large scale among those employed in the finishing department, who are busied in painting and burnishing, and in the decorative processes at large. All these employés sit continually at their work. The majority by far are women, and therefore it is not surprising to find the great prevalence among them of the common results of an in-door occupation entailing almost constant sitting: for instance, dyspepsia, anæmia, constipation, and derangements of function pertaining to females.

It remains now for me to say a few words *respecting health conditions, not necessarily connected* with the labour pursued; most of these obtain among manufactures of all sorts.

The proportion in which the two sexes are employed, and that of the young in relation to the full-grown, are circumstances which make their effects felt in manufacturing statistics. Until the Factory Act was extended to the pottery trade, children of eight years and under were put to work and employed for any time, whether night or day, that might suit the will of their immediate employers, whom, I may note, were the workmen needing their assistance. Happily, none are at the present period allowed to work half time under ten years old, nor any for full time who are under fourteen; exception however being made in the instance of those who have reached thirteen and have passed a prescribed standard at school, and then only if the certifying surgeon is satisfied respecting their physical strength and freedom from disease. In these particulars, therefore, we have an example of

sanitary improvement brought about by parliamentary action; but this external influence cannot be made operative in numerous matters influencing health injuriously. It unfortunately cannot make unsteady men steady, or those clean in their persons and work who have no conception of the necessity of being so, or those who are reckless careful in the presence of danger, or those who find close hot shops agreeable and who oppose the introduction of fresh air, sensible to the value of ventilation. Consequently we come across work-places and shops strewn with dust and bits of clay; men and boys badly clad and exposed to cold and wet; those using lead neglecting cleanliness and all precautions in its use taught by experience; and, lastly, both men and women, in all departments, whose greatest dread is fresh air, and who stuff up most assiduously any ventilators constructed to afford it to them.

Again, abundant insanitary conditions are too frequently to be found in the workmen's homes, in their habits when outside the factories, and in the food they make use of. But these and other like circumstances are not peculiar to potters, but prevail more or less among all workers in factories.

Though not an exhaustive account, sufficient has, I consider, been put forward to illustrate the sanitary aspects of the Pottery manufacture. We have observed the sources of danger to health in the materials employed—in the clay, flint, lead and colouring matters; in some of the processes as carried out—in the high temperatures so often involved, and in the modes of working. Over and above all such intrinsic conditions we have briefly called attention also to collateral or extrinsic circumstances affecting the well-being of pottery artizans. But of all the causes of illness to be discovered, dust from the clay stands pre-eminent, and happily it is one that can be overcome to a great extent by those means of ventilation and of extraction modern mechanical science has brought to so great perfection.

I will conclude by adding that there have been vast changes for the better during the last twenty years and upwards that the Factory laws have been enforced. Child-labour has been greatly curtailed, work rendered much more regular, and that at night practically almost abolished; numerous new factories, well built and roomy, have taken the place of dilapidated, damp and confined structures; machinery has been introduced, reducing materially the number of unskilled hands employed, facilitating work and giving it greater development; means of ventilation by fans and other contrivances have been adopted in most factories where there is steam power, with a consequent enormous reduction of the most active cause of illness, the inhalation of dust; and, as might be anticipated,

improvements in the mechanical and general sanitary conditions of their labour have been accompanied by a perceptible material and moral advancement of the employed. There is, nevertheless, ample scope for more; and ever onward progress may surely be looked for in proportion as more correct notions of sanitation extend themselves among all classes; as the ingenuity of mechanicians improves the appliances of labour and invents means for lessening evils attaching to it, and as education spreads and succeeds, instructing artizans in their true interests, both in respect to morals and to health.

Dr. G. H. Fosbroke said those who had listened to the paper had been instructed and interested. Dr. Arlidge had thoroughly described to them the evils accruing to the manufacture of pottery. He would like to call the attention of the Congress to another danger he had had some evidence of after pottery had been sent out and sold. His attention having been called to an outbreak of lead poisoning in his district, he found that home-made wines were largely consumed by the poor, and were generally made in the commonest class of earthenware pans, which were badly glazed and improperly burnt. Some six or seven persons he knew of were affected by lead poisoning, and he traced the origin of the outbreak to the fact that the wine had been made in such pans, and had been allowed to remain therein for some weeks to ferment. He was not able to obtain an analysis of the wine, but the circumstantial evidence was so strong that he had no doubt about it. Had Dr. Arlidge any similar experience?

Dr. Arlidge (Stoke-on-Trent) said, in reply to Dr. Fosbroke, that glaze, commonly used in pottery, is composed of lead and borax and some china clay, and that when this glaze coating ware is exposed to acids, and probably also to alkaline solutions for considerable periods, a decomposition occurred, setting free the lead, which then became a source of poisoning. Anyone could convince himself of this by applying one of the stronger acids to a glazed cup, saucer, or plate; and cases of plumbism are on record following the long action of salt or brine upon the coarser ware used for pickling. But some at least of this coarse ware is glazed by salt, and is therefore harmless.

On "The Transmission by Flesh Foods of Disease from Animals to Man," by WILLIAM E. A. AXON, F.R.S.L.

THERE has of recent years been an active Vegetarian propaganda in this country, and a greatly increased number of persons have adopted that system of dietetics, and many more, whilst not wholly Vegetarian, are so to a very large extent. Vegetarians have always contended, that however healthy in a natural state, yet, under the conditions in which animals are bred and brought to the meat market, their flesh must necessarily in many cases be diseased, and become a source of disease to the consumers; and the present trend of medical and sanitary science is in the direction of the position so taken. The recent decision in the Glasgow Sheriff's Court, by which tuberculous animals are judicially declared to be "unfit for human food," is a striking justification of the Vegetarian position, and may well prove to be the beginning of a new era in the history of sanitary science.

Flesh-meat may become a source of disease in several distinct ways. There may be an injurious influence resulting from the decomposition of the animal tissues after death, or they may have been affected by poisonous substances taken into the system during the animal's lifetime, or be tainted by parasitic or other diseases. There are numerous cases on record of death or illness from all these causes, but obviously the last is the most important to be considered in relation to the food supply of the nation.

There is no room to doubt the communicability of disease from the flesh eaten to the flesh-eater. Oxen, pigs, sheep, hares, deer, &c., are liable to become infested with tapeworm by swallowing the ova in their food. These eggs are hatched in the intestinal canal, and the young worms pierce the mucous membrane and the walls of the intestines, and so pass into the tissue, where they are surrounded by a sort of bladder. When eaten by man, these cysticerci have a further development, and are transformed in the human alimentary canal into the fully-matured tapeworm. One frequently fatal disease, hydatids, arises from the injection into the human system of the ova of the tapeworm (*tenia echinococcus*). That which is called measles in the pig is neither more nor less than the cysticerci bursting from their envelopment. The bladder worms infect calves, but the creatures do not survive when their hosts have reached the adult stage, and many thousand

pieces of beef have been examined without a cysticercus being found. Perfect cooking is said to destroy the vitality of the tapeworm, and to render it innocuous in food. Another horrible parasitic disease is trichiniasis, resulting from the small worm known as *trichina spiralis.* Dr. R. P. B. Taaffe says of this: "When the flesh of an animal which contains trichinæ is eaten, the young brood of trichinæ which are born pierce the mucous membrane of the alimentary canal and are conveyed by means of the blood-vessels and lymphatics, and distributed to all parts of the body; a pork chop will show them, whereas measles are principally found about the neck. It takes a space of four days for the brood to become distributed, during which time, if the infection is discovered, they can be dislodged, the remedy considered best being large doses of calomel. A portion of a muscle, taken after death from a child 4½ years old, was examined, and in one grain of the muscle 100 trichinæ were found. The muscles of an adult weigh 40lb., and, if infected in the same proportion as were that of the child, would contain 28,000,000 of trichinæ, quite a population to carry about; taking each of the trichinæ to measure about five to six millimetres in length, the 28,000,000 in a line would give 140,000,000 millimetres, or 90 English miles. One pig has been known to infect 158 persons, of whom 28 died."

The trichinæ, as a rule, are destroyed by cooking, but where this is not perfect there is danger, and accidents, sometimes fatal, are not infrequent.

Apart from parasitical infection, what are the diseases communicable from animals to man? There is some evidence as to cattle plague and swine-typhoid, but it is not so clear as to those of which we are now to speak. Dr. Gamgee says that the transmission to man of foot-and-mouth disease admits of no doubt. The same is true of the various anthracoid maladies. Anthrax can be conveyed by food, and is a specially fatal disease. There is at least a strong fear that erysipelas in animals is also sometimes transferred to man.

Lastly, and most important of all, there can now be no doubt that man may become the victim of tuberculosis from eating the flesh of animals infected with that disease. Tubercle is unfortunately very extensively prevalent amongst cattle reared for human food, and it is not always capable of detection during the lifetime of the diseased animal. Tuberculous meat is therefore constantly present in the markets, and often in enormous quantities. One of the first to call attention to the subject in this country was Dr. Henry Behrend, who, in 1880, wrote an excellent paper on the "Communicability to Man of

Diseases from Animals used as Food," of which, at my suggestion, the Vegetarian Society circulated several thousand copies in a cheap form. He has returned to the subject in an article in the *Nineteenth Century*, September, 1889, on "Diseases Caught from Butchers' Meat." The literature of the subject is growing rapidly, but Dr. Behrend's papers and Dr. Taaffe's address at the Brighton Health Congress, in 1881, on the "Propagation of Disease through Food and Drink," form good résumés, and Dr. C. F. Folsom's paper on "Our Meat Supply and Public Health" (Boston, 1875) is an excellent summary of the subject before the communicability of tuberculosis was generally allowed. In 1882 came Koch's discovery of the tubercle-bacillus. His experiments clearly showed that the disease could be induced by the transfer of tubercle from affected animals to others previously free from disease. So when the tubercle-bacillus, artificially cultivated, was introduced into the circulation of healthy animals, the bacillus was reproduced and tuberculosis resulted. The identity of the tuberculosis of man and of animals has been established by Dr. Creighton and other observers. The testimony alike of English and foreign physiologists and pathologists is that tubercle can be transmitted by the ingestion of the flesh and milk of diseased cattle.

Now, the undisputed fact that tuberculosis can be imparted to the human subject by the use of the flesh of cattle affected by tubercle is one of the greatest and gravest importance, for a large proportion of cattle have the disease, and it is one of the deadliest enemies of the human race. Painfully familiar is the dreaded name of "consumption," the popular designation of the class of disease that is responsible for one-fifth of the whole mortality of this country. In Paris it is said to be the weapon with which Death strikes down one quarter of his victims.

The Congress on Tuberculosis, held at Paris in 1888, called for the legal enforcement of the principle that the flesh of tuberculous animals should not be permitted to be sold, but should be seized and destroyed. A Departmental Committee of the Privy Council has, in this country, pronounced an equally emphatic condemnation, saying, that "although the bacilli may be found but rarely in the flesh, still the chance of their being present, either there or in the blood, is too probable to ever allow of the flesh of a tuberculous animal being used for food under any circumstances, either for man or the lower animals." This total prohibition of the sale of tuberculous flesh is now endeavoured to be enforced in Edinburgh and some other places, and an initial Glasgow attempt has led to a judicial inquiry by way of a test case before Sheriff Berry, when the whole subject was thoroughly debated on scientific and sanitary

grounds. The result is, that after hearing the evidence of experts on both sides of the question, the action of the local authorities is upheld, and the sale of tuberculous flesh is thus declared illegal.

Here it may be well to quote the remark of the *Lancet* (August 24th, 1889, p. 385): "Nevertheless, the doctrine of the infectivity of tubercle, and of the bacillus as the *fons et origo mali*, was so strenuously and widely adopted (so far as we can gather, only one expert confessed that he did not 'believe' in it), and had so much weight assigned to it, that it undoubtedly largely influenced the view taken by the judge. Yet it would have been quite possible to have argued the case and gained it without reference to the bacillus at all, and seeing how obscure is yet the question of its precise mode of action, this course might even have been adopted with advantage." That is to say, that whilst the bacillary theory is generally accepted, the evidence as to the communicability of disease by animal food does not depend upon that theory, but is independent of it.

The Jews, obedient to the laws of Moses, have always rejected tuberculous flesh, and are notoriously less subject to consumption than their Gentile neighbours. The chief rabbi of France says that sometimes 26 out of 30 slaughtered cattle have to be condemned. Some years ago it was stated that 80 per cent. of the cattle sent to the Metropolitan Dead Meat Market was more or less tuberculous. In Hanover 8,000 lbs. of tuberculous flesh was condemned in one month. Out of the animals slaughtered for the London Jews, 40 per cent. of oxen, 29 of calves, and 23 per cent. of sheep were rejected. According to some recently-published statistics of the Berlin markets, of oxen and cows there were 1,296 tuberculous out of 98,397, or 1·36 per cent.; of pigs about 1 in 1,300; of calves about 1 in 4,000; and of sheep and goats 1 in 5,000. The proportion of tuberculous cattle in the Glasgow market was given at ½ per cent. (*Lancet*, 24th August, 1889).

This brings us to the economical aspect of the question. The late Professor Leone Levi estimated the national expenditure on flesh-meat at £99,800,000; but if all tuberculous flesh is to be evicted from the markets it must lead to a great increase in the price of that which is left. Can the nation afford the addition of say another £25,000,000 to its butcher's bill? On a Vegetarian dietary the same amount of nutriment can be obtained at about one-tenth of the cost. Flesh food is thus dear as well as dangerous, and the substitution of clean and wholesome vegetable foodstuffs would increase alike the health and wealth of the community.

On "The Public Health in India, with special reference to the European Army," by Sir H. S. Cunningham, K.C.I.E.

India presents an interesting field to the sanitarian. Its wide area, its vast population, the uniformity of some of its conditions, the endless variety and wide diversity of others, the maladies which, in some portions of the country find their abiding home, the devastating epidemics which from time to time sweep across its plains—all offer admirable opportunities for observing the laws of life and health, disease and death on a grand scale. The statistics, now for many years assiduously collected and formulated by the Government, though still admittedly incomplete, are enough to establish many important results; while as regards several well-defined groups of the population—the army, the jails, and a few large municipalities—the observations have been exact and exhaustive, and the conclusions arrived at are of high scientific importance. A Government which rules over 1,500,000 square miles of territory and 250,000,000 of mankind—which yearly registers and tabulates 5,500,000 deaths among its subjects—which minutely scrutinizes the physical condition of between 60,000 and 70,000 European soldiers, 100,000 native troops, and a jail population of 80,000—whose officials each year conduct more than 5,000,000 of successful vaccinations—which annually relieves 11,000,000 patients in its public institutions—can scarcely fail to contribute from so wide an experience some valuable additions to the world's stock of hygienic information. The present is, moreover, a period of exceptional interest; for the Indian Government has recently introduced several fundamental reforms into the sanitary administration of the country. In July, 1888, it provided for the constitution of a sanitary Board in each Province, whose function it should be, not only to advise the Government on sanitary questions, but to act as the executive agency through which the Government orders in this department will be carried out. This arrangement had been long urged in India as a first essential of sanitary improvement. It was originally recommended by the Royal Commission in 1863, and was adopted, and, unfortunately, after a brief and imperfect trial, abandoned in 1865. This great reform—one of the most valuable legacies of Lord Dufferin's humane and enlightened *régime*—is supplemented

by others for stimulating and guiding the action of local bodies, and for supplying the necessary loans for sanitary undertakings, an omission which has hitherto been fatal to all projects of structural improvement. If loyally and energetically carried out, the new Government policy will revolutionize the sanitary condition of the country.*

That condition is, by this time, pretty accurately known in its general outlines, though many of the details have still to be filled up. We find the usual characteristics of a population living at a low level, without the knowledge or resources to protect itself against disease; its numbers, on the one hand reduced by enormous mortality, and on the other recruited by a birth-rate, which religion and custom, prompted by the instinct of self-preservation, combine to maintain at as high a rate as possible. The general recognition of the duty of early marriage, so imperatively enjoined by social usage, has, no doubt, arisen from the desire of communities—which war, famine and pestilence were frequently threatening with extinction—to guard themselves effectually against such a contingency. The registered birth-rate rises as high as 38 and 40 per mille in several provinces. The registered death-rate, which, for the whole Empire, averages 20 per mille, is recognised by all experts as recording scarcely more than half the real mortality. Three important provinces, where registration is carried out with some approach to exactness, had, in 1887, a death-rate ranging between 34 and 44·8 per mille; but mortuary statistics, in many instances—notably the great province of Bengal—record but a fraction of the real numbers, and this reduces the general average to a point far short of the actual numbers. It is certain, however, that death-rates of 50 and 60 per mille frequently prevail in many large cities and over considerable areas. In the N.W. provinces, in 1887, three Districts—areas as large as an English county—gave death-rates of 57, 66, and 71. In 19 of the 49 Districts the deaths exceeded the births, the excess in several instances exceeding 20 per cent. In 20 towns the mortality ranged between 50 and 85 per mille. In the Punjab 49 municipalities gave a death-rate of 46 per mille; and in a tract of country where, it must be feared, canal irrigation has added to the natural unhealthiness, the ratio rose to 61 per mille. Still higher rates have at times prevailed in some of the filthy villages which, to the disgrace of the Bengal Government, have

* It is a curious illustration of the rate at which things move in India that, up to a short time ago, the Bengal Government had failed to carry out the orders of the Government of India, passed in July, 1888.

been allowed, for many years past, to encircle the capital of India with a cordon of nastiness and disease.

Dealing, however, only with the recorded mortality of 1887, we find that the 3,500,000 of deaths out of 5,500,000 are attributed to fever. Bengal and the N.W. provinces each lost over 1,000,000 from this cause, a ratio of 16 and 25 per cent. of the total mortality; while in the Punjab and elsewhere an almost equally high rate of fever deaths was reached. Cholera, which is always responsible for a much smaller mortality than fever, swept off 474,000 lives in the entire country, of which Bengal contributed 172,000 and the N.W. provinces 200,000. There were 65,700 deaths from small-pox, the ratio sinking in Bengal as low as 0·05 per mille, and in no British province reaching one per mille. In fact, fever is the great destructive agency in India, compared with which all others appear insignificant. For this the climate to a large extent accounts. A great portion of the country is flooded or saturated during the monsoon, and its surface, covered with decayed vegetation, drying gradually under a powerful sun, presents all the most favourable conditions for malaria. In many instances the operations of the agriculturist enhance and prolong the natural saturation of the soil. In not a few, it must be confessed with regret, the evil has been aggravated by the engineering operations of the Government, which have resulted in over-saturating the soil, raising the subsoil water level to a dangerous height, and blocking up the natural water-escapes of the country by roads, railways and embankments, in which no proper allowance has been made for the surface water-flow.

In his last report, Dr. Gregg, the Sanitary Commissioner for Bengal, estimates that 22,000,000 people out of a total population of 66,000,000, suffered, in the course of the year, from fever. He points out that, flat as is the general surface of the soil, most of the towns and villages are situated on comparatively high ground, on the banks of rivers, with a natural flow away, so that the means of drainage exist, if they were not artificially impeded; and he records his opinion, as the result of many years' experience, that the existing culverts are totally inadequate and that their numbers should be at least doubled. The Bengal Government admits the justice of the charge when it observes, with reference to the Sanitary Commissioner's complaint, that "the waterway allowed in railway and road embankments is calculated rather with reference to the stability of the work than the sanitary requirements of the locality."

In upper India the ravages of fever in the water-logged localities around the great canals have long been notorious. They were forcibly described last year by Dr. T. H. Thornton,

a distinguished Bengal civilian, in an address to the Society of Arts.* Nothing, of course, can have been further from the intention of the Government than to contribute to so lamentable a result, and nothing can better indicate the paramount importance of efficient expert sanitary superintendence in a country, where, as in India, a mistake or oversight may involve wholesale disaster. Great structural works of drainage are often financially impossible; but there are humbler remedies, which would do much to reduce the fever death-roll of India. One of these is an improved water supply. At present the Indian peasant too frequently gets his drinking water from shallow wells, into which every form of surface pollution quickly finds its way; or from tanks, which are receptacles of the drainage of the village, and become in time little better than collections of rather strong sewage. Modern science has devised numerous effective means of water-purification by means of filtration. Many of the water plants of India have great oxygenising properties, and if the existing tanks were fenced off from contact, protected from surface impurity, and the water passed through filter beds before reaching the point of supply, an enormous improvement might be effected in the health of the population. No such experiment has ever as yet, so far as I am aware, been tried; indeed, it is only in a few of the principal towns that any attempt at a proper water supply has been attempted. Many important cities had not, as recently as 1887, accomplished this first essential of sanitation. Benares, Agra, Allahabad, Lucknow, Patna, Umritsur, Delhi, and Cawnpoor were among the notable delinquents. Delhi has long been a notoriously unhealthy station for European troops. In 1887 the rate of admission to hospital was 2557·2 per mille, and an average daily-sick rate of 85 per mille, and the death-rate 14·5 per mille. Benares had an admission-rate of 1442·1 per mille, and a death-rate of 30: Cawnpoor an admission-rate of 2019·8 and an average of daily sick of 90: Umritsur had an admission of 2619·3 per mille, a daily sick average of 108, and a death-rate of 25·5 per mille.† It would be curious to know what has been the money cost to the British Government of the valuable lives thrown away at these and similarly situated stations, by the persistent neglect of the first conditions of healthy existence.

The statistics show distinctly that the mortality among the

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* Journal of the Society of Arts, March 23rd, 1888. See also Report of Sanitary Commissioner for the N. W. P. for 1887, sections 44—55.

† See Table XX. in 24th Annual Report of the Sanitary Commissioner with Government of India.

general population is enormous; but the evidence is no less distinct that this mortality is to a large extent preventable. Obscure as are the laws which govern the prevalence of epidemics, and greatly as cholera and other like diseases may baffle the attempt of science to analyse the means of their generation and propagation, there is no room for doubt as to the efficiency of sanitary measures in curtailing their effects. Small-pox gives way before vigorous vaccination; and though a considerable per-centage of new births still escape the process, the disease has practically disappeared from many parts of India. Fever subsides wherever the super-saturation of the soil and other circumstances conducing to malaria are removed. Cholera, even in its endemic home and at the height of an epidemic period, fights shy of localities and communities which have protected themselves by sanitary precautions, such as pure water and careful removal of surface filth, against its inroads.* Wherever, in India, sanitation at all on the scale usual in England has been carried out, the death-rate has speedily sunk to nearly the English level. We are thus led to the conviction that, by measures within the practical competence of the Government and public in India, by reasonable expenditure and adequate and well-considered arrangements, a near approach to the English ratio may, and some day will, be attained. Such a change would save annually some four or five millions of lives, which are at present sacrificed to preventable disease, and, on the generally accepted ratio of disease to death, would obviate some 80 or 100 million cases of preventable disease. It seems to follow that, if this or anything like this be the case, the loss to the wage-earning community through premature death and needless disease, must be something vastly in excess of any expenditure which the necessary sanitary improvements could involve, and that an amount of human suffering—the vastness of which it almost baffles the imagination to conceive—is needlessly incurred. Thus considered, sanitary reform stands prominent among schemes for the amelioration of human life, such as occupy the Indian Government, and deserves infinitely more attention than it has been usual to accord to it. For it must be admitted that, while, as regards special bodies, such as the army and jail population, substantial improvement has been achieved, no practical impression has yet been made on the conditions which affect the general health of the community. In some instances there is good reason to fear that the action

* See Memorandum by Surgeon-Major G. Hutcheson on "Cholera as a preventable disease." Appendix B to 24th Report of the Sanitary Commissioner with Government of India.

of the Government has tended, as in the case of canals, very seriously to its deterioration. In its last Memorandum,* the Army Sanitary Commission, in calling attention to the enormous prevalence of epidemic disease in India, pointed out that 38 million victims, in a single decade, have succumbed to diseases of the mitigable or preventable order, such as have been combated with such success in other countries as to have practically disappeared, except in the milder forms in which they now occasion part of the ordinary mortality.

Such is the general nature of the task which lies before the Government in respect of the general population—one, surely, of vast importance to the well-being and happiness of mankind. A vaster it would be, I think, difficult to imagine. Little or nothing towards its accomplishment has hitherto been achieved, except to prepare the ground by showing its necessity, by proving by actual demonstration in several independent instances that its accomplishment is not practically impossible, and by providing the machinery by which, if public opinion be sufficiently stimulated to set it in action, its accomplishment might be realized.

I now come to the special subject of this paper, the health of the European force in India. In 1863 the Royal Commission reported that the death-rate of European troops in India had, for the period antecedent to their appointment, been at the rate of 69 per mille, that such an expenditure of life was perfectly unnecessary; and they indicated certain reforms which would reduce the rate to 20 per mille, and, ultimately, when the general sanitary condition of the country was improved, to 10 per mille. The first of these anticipations have been abundantly fulfilled, and some approach has been made to the attainment of the second. The decade, 1870–9, gave a death ratio of 19·3 per mille, and in 1883 the ratio of 10·8 per mille showed a close approximation to the lowest ratio which the Commission had indicated as achievable. Since then the ratio has ranged between 12·5 and 15·1 per mille; and though the death-rate was higher in 1887 than in some preceding years, the combined loss from death and invaliding showed a substantial gain on the preceding decade.

RATIO PER MILLE.

	Deaths.	Invaliding.	Combined Loss.
1870-9	19·3	43	62
1887	14·2	23	37

Against these satisfactory results must, however, be placed

* Memorandum of the Army Sanitary Commission for 1885.

some unfavourable circumstances which show that the task of the sanitary reformer with the European army is yet far from completion. The ratio of admission to hospital has, in several recent years, exceeded 1,500 per mille, a higher ratio than in the preceding decade; and the ratio of daily sick, which for 1870–9, stood at 60 per mille, has for three years risen to 70 or more.

RATIO PER MILLE OF DAILY SICK.

1885 ... 71		irrespective of the force on active service in Burmah.
1886 ... 75		
1887 ... 70		

It is obvious that an army, in which every man goes into hospital once and a half times in the course of the year, and which has continually 70 men out of every thousand on the sick list; and which, between death and invaliding annually loses 37 men out of every thousand, has something still to learn as to the special circumstances of the soil and climate, and as to the way in which the unfavorable sanitary conditions of the East may best be met. Whether the result be attributable to the larger proportion of young soldiers, or to the shorter period for which they remain in the country, there would seem grounds for believing that the liability to certain diseases is on the increase. Take, for instance, the heading of "fevers"—a class of disease—which accounts for a third of the entire mortality of the European army in India. The statistics for recent years are anything but reassuring. The death-rate from enteric fever in the Bengal army, which for the decade 1870–9 had stood at 2·28 per mille, stood, in 1886, at 5·7 per mille, and at 4·09 in 1887. The Madras and Bombay armies, also, exhibit higher death-ratios from enteric fever, while the death-rate from fevers of all classes, showed, in every Presidency, a substantial increase.

DEATH-RATE FROM ALL FEVERS PER MILLE.

	Bengal.	Madras.	Bombay.
1870-9	4·02	2·04	2·89
1886	6·69	4·74	4·43
1887	4·85	3·49	4·30

Such a state of things cannot but occasion anxiety to those whose care it is to render the European army as efficient an instrument as it is necessarily costly. If increased youthfulness be the explanation, it becomes all the more important to ascertain the causes which render youth especially liable to unhealthy influences, and the mode in which these can be most effectually

counteracted. "A young army," observed the Sanitary Commission in its last Memorandum, "involves, as one of its conditions of service, the most rigid attention to every sanitary requirement. The necessity of thorough ventilation, good drainage, dry barracks, the effectual removal of all surface filth, the improvement of localities by subsoil drainage, has long been universally admitted; but it is questionable whether there is not room in almost all branches for the more thorough and systematic recognition of their bearing on the health of a regiment."* A carefully selected dietary, first-rate rations, the discouragement of intemperance, and of the large consumption of alcoholic drinks which, though falling short of intemperance, tends to undermine the constitution in an Eastern climate, rations issued before fatiguing duty, a change of clothes when the soldier comes in heated from parade, well-placed, well-contrived, and well-ventilated barracks, a more general location at Hill Stations, more opportunities of useful and interesting employment —all these have been mentioned by military experts as matters which call for attention, and which might be made to contribute to an improved standard of health in the army. It is, moreover, absolutely essential that if a high standard of health is to be achieved, the country in which troops are located should not be allowed to remain in a pestilential condition. In Lucknow, for instance, the fever death-rate in the European force was especially high, 4·7 per mille; but this is easily explained by the circumstance that the fever death-rate for the civil population of the town was 29 per mille, and for the district 26 per mille. No precautions can effectually safeguard the army from deadly influences which operate thus powerfully on the population by which it is surrounded, and of which it forms a part.

Hitherto we have dwelt with attempts—hearty, and for the most part successful—to protect the European soldier from the diseases to which his artificial life in a tropical climate and his unsanitary surroundings render him especially liable. There is, unhappily, one class of diseases which we not only do not do our best to diminish, but which we deliberately encourage, if the abandonment of known means of mitigation and prevention deserves the name of encouragment. It is well known that there has been of late years, and especially since 1877, an alarming increase of venereal disease in the European army of India. The admission-rate has risen from a range between 166 and 196 per mille in the years 1871–1874 to 389 per

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* See also Minute by Sir H. Yule, K.C.B., published in Report on Sanitary Measures in India. Vol. XXI., p. 178.

mille for 1886, and 361 per mille for 1887.* Various causes are assigned for this increase. Owing to the abandonment of restrictive measures in England, regiments arrive in India in a more highly diseased condition than in former years. The proportion of young men is larger: in 1877 men under twenty-four years of age contributed only 33·5 per cent. of the force; in 1885 they contributed 47·8 per cent. The proportion of married men has sunk from 10·37 in 1876 to 3·84 in 1888. The shorter term of service and the more frequent movement of troops to various parts of the country are also believed to have contributed to the same result. Be the explanation what it may, the facts are undisputed. In 1887 we had 63,000 European troops in India, nearly half of them under twenty-four years old, all of them but a fraction—less than 4 per cent.—condemned by the rules of the service to celibacy, and removed from whatever humanising influences a home life may have possessed. Of this force no less than 23,100 men were admitted to hospital in the course of 1887 for venereal disease; of these no less than 9,000 were for various forms of syphilis, a disease which so seriously undermines the constitution that we have it on the authority of an Inspector-General of Hospitals, that fully two-thirds of the men who suffer from it are invalided within five years.† The following table shows the increase in each army since 1872:—

Admission Ratio per mille.

	Syphilis.		Other Venereal Diseases.	
	1872.	1887.	1872.	1887.
Bengal army	84·5	166·9	98·0	188·9
Madras ,,	94·6	209·3	68·8	124·8
Bombay ,,	68·4	175·4	82·0	189·8

The military authorities in India are thus confronted with the fact that out of every 1,000 men in the European army 361 are treated in hospital in the course of the year for venereal disease. Allowing twenty days on the average for each case, we get a total loss of 462,000 days of active service, and if in addition to this, it is remembered that in nearly 9,000 cases—those of the graver forms of the disease—the man's constitution receives a permanent shock, and the chances of his being invalided are seriously enhanced, it is obvious that the strength of the army as a fighting machine is seriously impaired.

The matter has, for many years, attracted the earnest

* See Blue Book Return, East India, Contagious Diseases, 1888.

† Dr. Duncan McPherson. See Note by the Surgeon-General and Sanitary Commissioner with Government of India. Blue Book, Contagious Diseases, 1888, p. 79.

attention of the Government, and various legislative enactments have been passed, providing for the supervision and control of the prostitutes with whom the British soldier is likely to consort. The strong feeling which exists in this country against any interference with prostitution, resulted, last year, in a resolution of the House of Commons, which amounted practically to the abolition of all the existing machinery of control and supervision. One principle laid down was that no woman should be liable to compulsory examination; another that there should be no system of licensing and so recognising prostitution. The Secretary of State's despatch in conformity with this resolution was a striking instance of the powerlessness of the Indian Council to resist English popular opinion acting on the Government of the day. The despatch was negatived by a majority of 9 members of the Council to 4; Sir John Strachey recording as his ground of dissent that "the inevitable result of these orders must be the complete abandonment of all efforts to protect the troops against one of the most serious dangers to which they are exposed, and that increase of disease must follow, with great diminution to the efficiency of the army." The Secretary of State, however, informed the Council that the despatch had been already sanctioned by the Cabinet, and that, despite the disapproval of the majority of the Council, he intended to send it to India.*

The Government of India is now endeavouring, subject to these important restrictions, to frame rules which may, to some extent, check the alarming growth of disease which has followed the removal of control. On a recent occasion at Simla, the Military Member of Council and the Commander-in-Chief concurred in describing the results of the recent change as disastrous to the army.

His Excellency, the Commander-in-Chief, showed by a comparison of the year 1883, when the Contagious Diseases Acts were in full force, and the present year, how serious the increase of disease had been in the Bengal army. "From this return," he said, "I find that at no station in 1883 did the number of venereal cases of sick in hospital reach 30 per cent.; at only two stations was it over 25 per cent.; while at some stations it was under 12 per cent. In June of this year at thirteen stations the percentage was more than 50, at a great many it was just under 50, and at the majority of the remainder it was 30 and over." Putting the same facts in another way: in July, 1883, the proportion of soldiers in hospital with venereal disease to the whole force was 1·77 per cent., in July of this year it was 3·5

* See Minutes of Dissent—Parliamentary Paper 220. 13th June, 1888.

per cent., or about double. Moreover the 1,548 men, who constituted the percentage, did not by any means represent the whole amount of disease attributable to this cause, as—owing to a change in the classification—a large percentage of the diseases, thus occasioned, are now returned under other heads.

The Viceroy, who expressed his warm concurrence in the views of his colleagues, directed attention to the serious restriction imposed on the Indian authorities by the Resolution of the House of Commons, and insisted on the absolute necessity of providing effectual measures "for preventing this particular form of disease from being propagated, which it appears to be at present without let or hindrance" . . . "To say that we are not to take steps of this kind appears to me to be tantamount to claiming for a class of disease, which is probably attended with more disastrous consequences than any other, with reference to its immediate and its remoter effects, an immunity which is not claimed for any other kind of contagious malady."

Two objections are urged by the opponents of the control of prostitution in Indian cantonments: one, that the control has been ineffectual; and next that, even though it may be effectual, it involves hardship and degradation on the class of women who come within its scope. As to the first of these it is, happily, possible to give a categorical reply. Practical experience has demonstrated, beyond the possibility of dispute, that control, even if incomplete and inadequate, does exercise a potent effect in reducing the amount of disease. The history of the subject in Calcutta amounts to demonstration. The Act was put in force in that city in 1869; it was suspended in part of the city in November 1881, and in the entire city in March 1883. The following figures tell their own tale with sufficient explicitness.

GARRISON OF FORT WILLIAM.

	Ratio per cent. Primary Syphilis.	All Venereal Diseases.
1869	10·0	25·0
....		
1873	1·4	7·4
1874	1·4	9·4
1875	2·3	10·3
....		
1883	10·9	28·0
1884	30·2	58·14
1885	15·10	31·6

From these figures it is apparent that, in 1873–4, syphilitic

disease had sunk from a high ratio—10 per cent., to a low one —1·4 per cent. In 1883 it springs to nearly 11 per cent., and 1884 to 30 per cent., while 58 per cent. of the garrison are affected, with one form or other of venereal disease.

Another convincing experiment was tried by the Government in 1885. Doubts having been expressed as to the efficacy of the Lock Hospital system, the military authorities determined to close a certain number experimentally. The result, as described by the Surgeon-General of India was as follows:—"13,443 men were left without protection, and, in consequence, in every thousand of the men 192 more admissions for venereal disease than the average of the preceding ten years during which they were protected." In order to be more precise the Surgeon-General deducts 61·2 per mille, which may, he considers, be attributed to the natural increase of an especially unhealthy year. "The result of the experiment means that 130·8 men per mille of those who garrisoned cantonments where lock hospitals were closed, contracted venereal disease, who would not have suffered had the hospitals remained open. As the strength of the army was 56,967, this again means that the experiment caused 7,451 more admissions than would otherwise have taken place, and assuming, as before, that each case remained, on an average, 20 days in hospital, this would represent 149,020 days of inefficiency."

On the whole the statistics adduced by the Surgeon-General are absolutely conclusive as to the enormous efficacy of preventive measures in checking disease of this order in the army. Let anyone who is inclined to feel sceptical on the point consult his Memorandum, and especially his summary of the history of the subject at p. 87 of the Blue Book. It is, I think, impossible, after perusal of this document, to feel any reasonable doubt that we have it in our power wherever we choose to enforce the necessary restrictions to put an end practically to the more serious classes of venereal disease in the army,—in other words, to rescue nearly 11,000 men annually from various forms of syphilis.

Of the effects of this disease on a European constitution in an Eastern climate there is, unhappily, no room for doubt. I have already quoted the opinion of Inspector-General McPherson that fully two-thirds of the men who suffer this disease are invalided within five years. As each soldier costs the Government £150 before he arrives at an Indian Cantonment, this in itself is no small consideration. But the claims on the ground of humanity are infinitely stronger. There is, in the first place, the unquestioned fact that the disease is hereditary as well as contagious, and that innocent women and children

have frequently to suffer for the husband or father's indiscretion. As regards the patient himself the Viceroy spoke advisedly when he described the disease as "probably attended by more disastrous consequences than any other with reference to its immediate and its remoter effects."

The Surgeon-General of the Bombay army in supporting H.R.H. the Commander-in-Chief in his protest against any interference with the existing rules, gives a really appalling account of the after consequences of this dreadful malady. After mentioning the conditions in which it does directly endanger life, he proceeds—"It is, however, indirectly and remotely that syphilis proves so very destructive to life. Indirectly, there is no disease which causes greater mortality as well as all kinds of misery." In questioning patients as to their previous history, how often is it found that the first link in the chain dragging them to the grave is syphilis? M. Ricord regarded it as the "most terrible contagion which ever threatened mankind," and Ricord's experience was immense. It is tertiary or remote syphilis which is the most destructive. Diseases of the eye, especially iritis, often ending in blindness; diseases of the spinal chord, terminating in paralysis; diseases of the brain, ending in a similar condition; diseases of the heart, the forerunner of dropsy, all result from syphilis. In a recent address on cardiac maladies before the British Medical Association, Sir Dyer Duckworth stated, "Later on in military life the influence of syphilis comes in and aneurism results. In short, disease of most internal organs has been fully traced to those degenerations and formations which result from venereal." In particular the Surgeon-General indicates liver-disease, dysentery and fever as much more closely connected with a syphilitic taint than is ordinarily imagined to be the case.

Such is the malady which, as matters now stand, we intentionally and deliberately inflict on 11,000 British soldiers in India every year. We do it with our eyes open: we know how to produce the result, we know how to prevent it: we advisedly choose the former course. Did ever folly perpetrate a more cruel absurdity?

As to the moral aspect of the question, I desire to speak with all respect to the motives and feelings of those whose agitation has been instrumental in bringing about the present lamentable state of things in the British army. I value morality as highly as they do; I regard the dignity of woman and the sanctity of virtue with as sedulous a reverence as theirs; but I maintain that to take 70,000 young English peasants at the time of life when animal passion is most imperative; to carry them away from all their natural surroundings, to enforce on them a life

of celibacy, and to plant them down in stations, where, owing to the absence of precautions which, though proved to be effectual, we deliberately refuse to take, it is absolutely certain that incontinence will be followed by a loathesome and dangerous disease, is to commit an act of folly and cruelty of which every Englishman has reason to be heartily ashamed. It is no question of female degradation, because the low class of prostitutes with whom the soldiers consort, can only be benefited by any arrangements which rescue them from loathesome disease and suffering. In many cases the women themselves recognize the advantage of protection from what is the curse and terror of their lives, as is proved by the fact that a daily average of about a hundred prostitutes still spontaneously frequent the Calcutta Lock Hospital; the only difference being that, whereas, under the compulsory system, the women were taken at an early stage, and the "worst forms of the disease had practically disappeared,"* the Lock Hospital is now, the officer in charge informs me, filled with wretched creatures, who creep in—a living mass of pollution—to end the protracted torture of existence.

There can be no doubt that the graver forms of venereal disease might be banished from our Indian army by reasonable precautions—reasonably, humanely and decently administered throughout European cantonments; but equally there can be no doubt that, handicapped as it is by the Resolution of the House of Commons, the Indian Government cannot enforce these precautions; and representing, as I know that I do, the views of many experienced officials, who have the interests of the army at heart,—of many eminent medical men who know the real facts of the case and the lamentable results of the recent Resolution of the House of Commons, and of large numbers of laymen who object to exposing thousands of their countrymen to unnecessary suffering and disease,—I desire to protest, in the name of common sense and humanity, against a policy which practical experience has shown to be disastrous, and which sacrifices real and tangible advantage to morbid sentiment and spurious morality.

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* See evidence of Surgeon-General Payne, quoted in Blue Book, "Contagious Diseases," p. 63.

On the "Unsanitary Conditions of Domestic Animals," by A. Le Grand.

ABSTRACT.

In spite of laudable efforts to improve the lot of domestic animals, it is astonishing to what a small extent advance in this direction has been made. The sanitary condition of animals that contribute to our daily food is of the most vital importance. First comes the cow. Its milk serves for our daily nourishment from the cradle to the grave, and many are indebted to it for their very existence for the first few months after birth. Looked at from the most selfish view, it is essential that such an indispensable animal should be kept in a healthy state. Of the condition of cows kept on grazing land, and driven night and morning into sheds, there is little to complain, except that frequently their only drinking fountain is a dirty mud hole contaminated by field drainage. The unwholesome effect of such water upon cattle hardly needs comment, and is it to be expected that cows drinking such foul fluid can yield wholesome milk? The farmyard well is more often than not polluted, while the horse-pond is frequently little better than the mud hole. In and near towns the cows exist in sheds, pent up for months without exercise; their existence is one monotony of standing, eating, lying down, and chewing the cud. Instead of pasturage their foods are more or less artificial, such as oilcake and brewers' grains, only occasionally varied by green herbage. In the summer, fermentation rapidly sets up in grains to the detriment of the cow so fed. Except in first-class metropolitan dairies, cow houses are insufficiently lighted, and seldom a ray of sunshine enters them, and yet daylight and sunshine have as much to do with the health of an animal as good food and exercise.

Many of the foregoing remarks apply equally to the ox or sheep. The condition of an ordinary straw yard should not be overlooked, and for a number of animals to be standing all day long knee deep in rotting manure is, to say the least, both unnatural and injurious. Hard as is the state of a pent-up cow, it is Princely compared with the pig. Rarely he may be seen happily grazing in an orchard, varying his fare with fresh windfalls, for he is often too dainty to touch the apple that has laid too long on the ground. So far as food goes the average

farm pig has little to complain of, but his domicile is simply disgusting. He has scarcely room to turn in the uncovered part of his sty, and so must wallow in filth, and his feeding trough being in the same compartment becomes inevitably contaminated. The covered portion of the sty is, if anything, smaller, and, in point of cleanliness, little better than the uncovered part. The fate of the suburban pig in poor districts is still worse. The stench of the garbage they are fed upon from reeking tubs makes the chance of their furnishing wholesome food for man very remote. Their food includes slaughter-house offal, refuse and leavings of hotels and dining-rooms, including, as often as not, pork as well as other meat. This is collected daily in carts which, from their appearance, it is safe to say are never cleaned. In summer time the stench of these carts quickly warns the passer by of their approach, and the food put in them at once commences to ferment and decompose. Can it be wondered at that trichina, fevers, and divers other diseases are rife among pigs thus herded and fed. Is it not reasonable to infer that diseases are engendered in those who eat the flesh of these pigs?

Brief reference may also be made to the conditions of those animals which minister to our necessities or pleasures other than by yielding food. Even the horse, though mainly well cared for, is often no more intelligently shod than it was 100 years back. In the average stable there is want of sufficient room and ventilation which causes the strong smell of ammonia, and an absence of adequate light appears to be the general rule. The cubic feet necessary for a healthy stable seem to be little considered. Passing notice may also be given to that companion and friend of man—the dog. Many of these are over-fed, and get little or no exercise. Some are chained up from one year's end to the other, getting no exercise at all. Kept in such a condition, the dog becomes a most offensive and unwholesome animal, and its state must be one of great misery, conducing most certainly to disease, possibly hydrophobia, and in some cases to dangerous ferocity. Even the sanitary condition of the hounds shows something wanting, as occasionally a whole pack is annihilated by disease, probably caused by their being herded together. Other animals might be enumerated, but sufficient has been cited for making no apology necessary for bringing the subject before such a Society as the Sanitary Institute.

On "Athletics and Gymnastics in Use and Abuse," by William White, F.S.A., F.R.I.B.A.

It must not be thought that an architect is travelling out of his proper province in addressing this Institute on a subject which has not even a remote relation to constructive sanitation. Professional men and others of a sedentary occupation, ought to be specially interested in all that relates to the edification of their bodily structure, and to the due fulfilment of the duties of their calling. Happily at the present day, with our increased aids to mental culture, we are taught the vast importance of physical development also.

It has been supposed that severe bodily exercise contributes to the development of exceptionally great intellectual power. This has been maintained mainly on the ground that bodily movement is recreative from mental exertion. Great names have been quoted as illustrating and corroborating this supposition. And some of our highest academical honours have been gained by men who have also been amongst the most noted for boating, cricket, football, pedestrianism, or other athletic exercises. But the doctrine must be taken only for what it is worth; for we find that many have done themselves irreparable injury by indulging in over-violent exercises whilst engaged in severe mental strain. The fact is that muscular equally with mental exertion is exhaustive of brain power; and it is held by many medical men now that all who are deeply engaged in study should give themselves only moderate but regular daily exercise, never approaching to exhaustion. We must not burn the candle at both ends. There may be exceptions when men endowed with great physical as well as mental energy have seemed able to do almost anything with impunity. These are the men who come before the world as athletes in mind as well as in body, but it is by no means the common lot of men.

I suppose no race at the present day has greater physical energy and bodily endurance than our own. And this, as characteristic of the English nation, finds not only expression but expansion and perpetuation in our national pastimes. Men have at times practised severe, if ill-advised, special training for competitive purposes. To such an extent was this carried some years ago, that in order to promote the fullest formation of

muscle, the food of boating crews was made to consist chiefly of uncooked beef browned over on the outside. Like the Spartans of old, they were ready to submit to severe discipline, but the discipline was neither wholesome nor agreeable. At the present day the limitations and allowances of diet are much better understood, and are more *intelligently* acted upon by *intelligent* men. The old system had its uses, in the promotion of moral discipline, and in the survival of the fittest. Many failed under it; the weak ones went to the wall, whilst those whose good constitution enabled them to bear up under it became the foremost in their day in their respective pursuits. Such training is not now thought needful, or indeed good; and athletes are subjected to little more than the observance of the ordinary rules of health. But stimulants should not be taken either before or during any great exertion, and it is essential that all food, especially farinaceous and other soft substances, should be thoroughly masticated. In some Oxford training, pastry is forbidden, and more than a half-pint of beer.

A sanitary condition is that in which all the forces of the body are equally balanced; disease is that in which some one or more of the parts are defective, or else over-developed. And in athletic sports and manly games many young men have been, and still are being, seriously and permanently injured in bodily health as well as in mental vigour, merely because being ignorant of this they have neglected or refused to take proper precautions. Even growing children have been left too much to their own inexperienced instincts of what they may or may not be able to bear. All, however, seem to be impressed with the idea that active exercise is the one thing needful, and that the more severe the strain imposed upon the body the better it is likely to be for them. They are by no means impressed with the same regard to the restraints requisite to impart vigour to the constitution.

From our earliest childhood we have been taught that the best exercise for everyone is that most easily attainable one of walking. But it really is not so; and unless children are strong and in perfect health, long and forced walks are absolutely injurious. Undue exertion is thrown upon the legs and dorsal muscles without any compensating influence upon other parts of the body; such is the system of coercive exercise given in educational establishments which perversely and perseveringly adhere to what may be fitly called "pedagogical pedestrianism." Growing children, even in open spaces and where they might with advantage enjoy a little freedom, are still condemned to the old rule of a monotonous, tedious, and wearisome tramp. A child's instinctive exercise is romping and

play, by which every muscle is brought into healthy motion; and with the adult equally the same amount of diversity of motion is needful for the maintenance of his health. The arms, the shoulders, and the back, must have their equal share in the work.

Now let us look for a moment at the difference between mountain climbing and the ordinary "constitutional." Along the high road we may find in perfection the monotony of muscular action, with its corresponding tedium and fatigue. In mountaineering we may find the most enjoyable recreation that is to be had. We come face to face with the grandest and loveliest forms and features of nature, in the freshest and purest air, and with the delights of the free exercise of our limbs. But further than this, which is more to our present purpose, the inequalities of the way, and the active use of the alpen-stock, bring fully into play the whole muscular system. Even those who by habit of life, or by want of vigour and endurance may not be fitted for such work, can solace themselves with shorter excursions and lower elevations, which, however, they will find equally beneficial, as being the best suited to their respective needs, and perhaps on these accounts also equally enjoyable. But, unfortunately, there are many who fail to find the benefit and the pleasure which they ought to derive, merely through their lack of knowledge, or of will, to follow the course which the laws of health and the instincts of common sense would point out.

The injurious effects of violent movements may perhaps be the best seen by the reverse picture, in the invigorating and curative effects of regularly recurring movements properly and systematically directed, to give relief not only to muscular defects or injuries but also to many diseases. In medical cases the principle upon which such movements are prescribed is not by treating the injured, overstrained, or defective local members only, but by general treatment also. Great care is required to avoid throwing undue strain upon any set of muscles or functions; and the more equally and thoroughly the whole of the muscular system is exercised and strengthened, the greater will be the curative effect.

The various games now played in England are well adapted for the exercise of the whole body, but probably one of the best we have is lawn tennis as giving freer scope for the exercise of the arms and body, in all positions, without necessity for excess of muscular strain. For the vigorous and robust a great deal may be said in favour of the modern mode of football and cricket; but for mere healthy exercise these games have ceased to be so generally useful as they were

formerly, on account of the roughness, violence, and needless dangers which seem to have become inseparable from them. This is especially the case in football, which has given scope for the display of brute force rather than of rational sport and scientific action, and to such an extent as to create even in reasonable and sensible persons a prejudice against it altogether.

It would be difficult to exaggerate the importance of attending to small details for the preservation and promotion of health, whether in all that the athletic world opens up to us, or in the training of the young to fit them for it. At the same time we should be especially careful to guard against the encouragement of what is called "coddling." Remember, careful mother, that the natural tendency of coddling is to weaken the will and to lessen the powers not only of the endurance of bodily ills, but also of the resistance of moral evil, besides making your youthful prodigy fearful of fresh air and cold water, or of any little inconvenience. But others, recognising the moral obligation of self-denial for the promotion of health, have advocated what is popularly known as the "hardening process." Our young people are to be braced against all feeling of cold or of discomfort; they are habitually to disregard sudden changes of temperature, draughts, and chilling influences of every sort. Doubtless it has proved a boon to such as could stand it, making them practically independent of trifles which tend to habits of self-indulgence. But this again has led full many a time to a reckless disregard for things which are really requisite for self-preservation. Young men ostentatiously give up overcoats and comforters; they profess a singular disdain for cold and wet, and for the discomforts incidental to outdoor pursuits in a severe and trying climate; they rise to a sense of superiority to all around them, which often leads to failure, and a consequent recourse to the very coddling from which it has been their laudable endeavour to escape. Thus the hardening process becomes but one degree better than coddling, not one whit less injurious and foolish. It may be better as promoting self-denial; but even this requires to be properly directed, or the hardening process will prove to have but a softening effect upon those who cannot endure it. Even a strong constitution may be permanently injured by reckless exposure. The very fearlessness which commonly accompanies a good constitution may thus become a source of weakness and of danger, particularly when combined with a vain desire to display it. I should be sorry to seem to depreciate or to discourage in the slightest degree the active energy and endurance which are the glory of the rising generation, as they have been of the past; but there are many who will enter recklessly upon a course of violent

exercise, or of severe self-discipline, with no previous training, and with no special fitness for it; and I wish to combat the notion that undue exposure and discomfort will necessarily fit and prepare the young and the weak for severe strain or for habits of endurance. I contend that chronic ailments ought to be met with chronic treatment, and by a careful avoidance of such accidents and circumstances as may have a natural tendency to increase them. I remember, as a child, the reply made to my mother by one of her maids, whom she scolded for exposing herself to the cold wind on the wet grass without protection whilst hanging up clothes: "Oh, ma'am! I'm sure it can't make no difference, for I 'most always has a bad cold."

And I wish to emphasize the principle of self-protection, in those athletic and gymnastic exercises which are undertaken more especially for the benefit of the health. The weak parts of the constitution require guarding and strengthening, not over-working and straining. Chances of injury should be avoided for fear of its permanently weakening effects. When I say "for fear," I use the term only in its popular not in its proper sense, for if there were but more proper fear there would be less danger. A severe chill, for instance, has induced bronchial, pulmonary, or muscular injuries, which have rendered the system through life certainly not less susceptible of subsequent attacks, but very much more so.

But again, nervous fear of consequences may make us only the more susceptible of the very evils which we dread. It is said that an active sanguine conviction that we shall not suffer from an accidental exposure, to cold or wet for instance, has an exciting and wholesome effect upon nerve action which tends to keep up the circulation and strength. This comfortable conviction may be of considerable value and use, just as a man may be induced to try his utmost to keep himself awake in order to prevent his being frozen to death. Still, it would be mere trifling to suppose that such a temperament will save us from the effects of imprudence or chill.

A course of gymnastics then, if properly regulated, is beneficial for the maintenance of health, as well as for its recovery when lost. Other nations have, till recently, been far in advance of us in this. In Col. Ling, the true soldier, scientist, poet, and Christian, Sweden produced the pioneer, to be followed by Germany and France. In Sweden all children have to go through a course of what is there known by the name of "Health or Educational Gymnastics," directed by properly qualified teachers, whether with or without apparatus; and it is Sweden that has established a highly scientific code of medical movements, as formulated by Ling himself, for the relief or cure of

diseases which can scarcely be reached by medicine alone, such as spinal curvature, diseases of the heart, and derangements of the nervous system or vital organs. In England at the present day Massage (which is also used in Ling's system) has been much employed, and too frequently ill-done, or over-done, by many, it is to be feared, who have had only a mechanical training, little knowledge of physiology, none perhaps of anatomy and pathology, and absolutely no experience of the movements often required to give permanent effect to the massage. A few English medical men have availed themselves of its aid, but Ling's system, in its entirety, has as yet received but little or no recognition here. A few properly qualified Swedes, of both sexes, may be found in London. And there are several others who are carrying out a development of their own rather than Ling's system. Several English medical men have visited the Royal Central Institute at Stockholm, but I believe none have gone through the whole course.

To the biennial medical course at Stockholm, established for the training of twenty Swedish women, three or four foreigners are admitted, but as yet only one English lady* has passed through it and obtained her diploma. A second, I am glad to say, has now been accepted as a student; let us hope this may be the beginning of a far more extended use of the system in England.

Now that the subject attracts so much attention, it may be of interest to note that both massage and movements were freely used by the ancient Greeks and Romans for medical no less than for athletic purposes. Happily educational gymnastics are being now introduced more and more into our board schools. Gymnasia have a promising prospect, and their promotion is worthy of the aid of this Institute. Amongst the notices upon the County Council's Bill, I rejoiced to see one made (by Lord Charles Beresford I think it was) that a public gymnasium should be provided for all populations of 10,000. But without waiting for this a great deal is being done in various parts to carry out this system by voluntary means, and we may hope that ere long people generally will learn to take it up and profit by it.

Mr. Frederick Scott (Manchester) said he was connected with an institution in Manchester which illustrated very well the uses of gymnastics as described by the last speaker. This was the gymnasium erected at considerable expense in a densely populated part of the

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* The author's daughter.

city by the Committee for Providing Open Spaces for Recreation. One of the original objects of this society was to induce the Corporation to allow available parts of the public parks to be used for active games. These parks have been almost exclusively maintained as ornamental grounds, and the society had been unable so far to induce the Corporation to take the desired step. But in order to show a lead to the Corporation they had purchased and suitably laid out a field, now freely used for cricket, football, &c., and it was with the same purpose of demonstrating its utility to the Corporation that they built the gymnasium and employed a skilled instructor. This latter provision he deemed essential to the successful use of gymnastic exercise as an aid to health, for without intelligent direction gymnastics were as likely to be harmful as the reverse. The use of the out-door gymnasia in the public parks was not without drawbacks, but at a recreation ground furnished by the society he referred to, which was under the charge of a suitable man to direct the use of the appliances, excellent results had been obtained. The covered gymnasium had been remarkably successful; they had trained there about 2,000 youths in six years, many of whom were "corner boys" or "scuttlers," who at one time were constantly being brought before the magistrates for rough behaviour in the streets. Now no one could go to the assaults-at-arms without being struck by the "shapely form," spoken of by Canon Creighton, and the generally graceful bearing of the youths. The regard for order acquired by them was also remarkable. There was a gallery in the place, and the public were allowed in to see the exercises of the lads. At first some of the persons who came ignored certain rules as to "Silence," "No Smoking," &c., and made rude comments upon the performances of beginners, but lads who had themselves been very rough when admitted soon became most exacting as to the observance of propriety, and acted as their own policemen, by "chucking out" a few times those who persisted in misbehaving themselves. As a result, the order amongst the on-lookers is now, as a rule, all that could be desired. In order to ascertain the results of the training, he (Mr. Scott) had asked the instructor to take some measurements of the chest on the youths, and several cases were recorded where the girth of the chest had, after three months' training, increased as much as from one and a half to two inches. They had, too, a remarkable testimony from the Chief Constable of Manchester as to the effect this institution exercised in promoting order in the district. Whereas the police before its establishment had great trouble in repressing disorder created by youths, now the district was remarkable for its comparatively quiet and orderly character. He (Mr. Scott) did not think there had been a single instance of injury to health from practice in the gymnasium, except in a few cases of accident—as, for instance, when a novice using the trapeze during the absence of the instructor fell and broke his arm. His experience of this gymnasium enabled him to state that the results had been uniformly good, so that within the restrictions named by Mr. White he thought the

practice of athletic and gymnastic exercises could only be a benefit from a sanitary, an æsthetic, and a moral point of view.

The President (Dr. G. Wilson) said he thought Mr. White attached too great danger to athletics as carried on at the universities. He thought there was no cause of disease which was followed by so many elements of a doubtful kind as neglect of exercise. He was strongly of opinion that every healthy man ought to take an amount of exercise equivalent to at least a walk of eight miles every day, and every healthy woman ought to take exercise equivalent to a walk of six miles a day. He was very much surprised that the High Girls' School at Worcester had no gymnasium. He did not know whether they were exercised in the way of pedagogic pedestrianism—which Mr. White had brought before them, but he hoped that long before they visited Worcester again the High School for Girls would at all events be provided with a gymnasium.

On "Woman as a Help-mate in Sanitary Reform," by The Mayoress of Worcester (Mrs. Ernest Day).

In complying with the request to write a short paper on one branch of the wide subject of "Woman's work relating to sanitation and household management," I must at once disclaim any intention of attempting direct teaching. My only excuse for occupying your time at all is the desire I feel to encourage others to seek information, for doing which the present opportunity offers such unusual facilities.

One of the principal objects of such a Congress as this would fail if women held themselves aloof, thinking it did not affect their life work. The growing advantages which we women of the present day enjoy, in better education and higher development of our intellectual faculties, increase our responsibilities. One of the legitimate ambitions of woman is to become more fully the intelligent companion and mental help-mate of man; but I fear that in our effort to cultivate this hitherto rather neglected side of our nature we are sometimes in danger of losing sight of the importance of the more material and less attractive duties which come immediately within our peculiar province.

After all, if we, as wives and mothers, do not wisely govern

our homes, making them the abodes of real peace and happiness, we woefully fail in our mission in life.

Perhaps, here and there, a woman possessed of real genius may be pardoned for neglecting these obvious and every-day duties; but such women are brilliant exceptions, and it is hardly to be wished that they should be other than exceptions. Without desiring to go back to the days of endless toil in unproductive needlework, may we not with advantage imitate the devotion of our grandmothers to home problems, which is gradually becoming a rare accomplishment, and may we not do this in a far more intelligent and helpful manner than they did?

No liberal-minded man wishes his wife to be *merely* a superior cook, or nurse, and, on the other hand, no woman ought to feel herself thoroughly educated, and competent to become a wife, unless she has a theoretical and practical knowledge of the laws that make the health and happiness of her household.

When the preparation of our food, and the management of our homes, depend solely on the slip-shod knowledge obtained from tradition, confined to dogmas which do not touch the understanding, it is a poor thing; but when the knowledge is based on regard to scientific fact, it becomes a study not unworthy of intelligent pursuit.

In an age when women are so anxious to take up outside work, when the inequality between the sexes is becoming less marked, are we not somewhat in danger of losing the substance for the shadow? There is such a wide field of useful labour before us, where we may fairly claim more aptitude than men, where our thorough proficiency must tend to make us such a tremendous influence for good, if once we grasp the full possibilities of the situation; possibilities, which we sometimes neglect as beneath our notice, while we struggle and agitate for a larger share of man's work, forgetting that until we are perfect in our own immediate sphere, we are hardly fit to incur fresh responsibilities.

Is it not, therefore, a positive duty, incumbent on all who have the guidance and education of girls, to see that they are brought up with a thorough knowledge of the elementary laws of domestic hygiene? Too often the young lady of the present day considers the personal supervision of domestic details, which affect the sanitary condition of the house, as beneath her; but if we accept Dr. Richardson's views of the duty of modern women:—"to know the first principles of animal physics and life; to learn the house and its perfect management; to learn the simpler problems relating to the fatal diseases; to ordain the training of the young; to grasp the elements of the three

psycho-physical problems—the human temperament, the moral contagions with their prevention, and the heredities of disease with their prevention," we shall have attained to something beyond superficial acquirements; and we shall not be less cultivated or refined because we have a thorough comprehension of the laws which govern our bodies, and the sanitary details which conduce to health.

Pure air, pure water, and a properly selected diet, are alike necessary for a healthy life; if these could be obtained most of the diseases which afflict the human race would disappear. Food alone plays such an important part in the welfare of mankind, that a true knowledge of its properties should be widely taught. When we consider the wear and tear of the human frame, and know in what proportion we require the different foods—flesh-formers, warmth-givers, minerals, and liquids, we shall cease to look upon even the ordering of dinner as a trivial matter, and we shall, I think, find common-place details dignified beyond our expectations. The use in undue proportion of any one kind of food, however good, means to some extent loss of health and vigour; a right choice of food becomes, then, of importance to us all; but to the woman who has to supply the wants of a family at the smallest possible expenditure the knowledge becomes infinitely more essential; it would be difficult to over-estimate to her its importance, and it would be, I fear, equally difficult to exaggerate the intense ignorance and lack of interest shewn by those most affected. Dr. Richardson says "if woman only knew what foods were requisite to feed the skeleton, or bony frame-work of the living body, while that skeleton is in the course of growth, and if she would act upon the knowledge, as she most certainly would if she possessed it, there would hardly be one deformed child left in the land in one or two generations."

All we who have any experience amongst the poor, know how much the lack of good home-management affects the happiness and health of our towns. Conventionality of a determined kind meets us at every step in our efforts to educate the wife of the working man, in respect to economy, and the laws of health. We need only instance the waste that goes on daily in the preparation of food, and the want of judgment displayed in its selection. It is difficult to persuade women to any new departure in their manner of house management. "They have always done a thing this way, their mothers did it before them," and they distrust any new-fangled notions which seem to involve more trouble.

An idea which prevails is that meat is the great desideratum; the nourishment contained in fish, milk, peas, beans, lentils,

and other pulse plants is overlooked. It is true that the cookery lectures have done much, but much still remains to be done in popularising the information, and in this direction women may become real missionaries to their uninstructed sisters. May they not, by the introduction of short, bright, homely lectures on cooking and the elementary rules of domestic hygiene, at mothers' meetings and in the various clubs provided for the social recreation and instruction of girls, bring about many wise reforms? Where it is impossible to get any lady to speak to the women or girls, I would suggest the reading aloud of some of the popularly written tracts on the subject, published by the "Ladies' Sanitary Association" or the "National Health Society;" but these will fall very short of the good they may effect, if the reader be not thoroughly and practically acquainted with the subject, and able to enter into friendly chat over the individual difficulties which may arise. To explain my meaning by a simple illustration:—It is not interesting to tell a woman that she should make beef tea by cutting up the meat into small pieces, pouring on to it cold water, and simmering. These are facts, but how easy it will be for the girl, without any previous practical experience, to forget the apparently unimportant detail of whether the water be cold or boiling, and thus defeat the desired object. If, on the contrary, we have intelligent perception of the subject, we shall first explain, what, doubtless, most of my hearers know perfectly well, that all meat contains a large proportion of albumen, that this albumen hardens in boiling, and prevents the extraction of the nutritive properties contained in the meat. Once this principle is grasped no mistake can be made.

Give to an inexperienced girl, understanding this first principle, two legs of mutton; tell her to boil one and make soup of the other; she will not be at fault; she will know that in the one case it is desirable to retain in the joint all the nutritive properties; that in order to do this the outside albumen must be set, or hardened, at once by contact with water at boiling point; but she will also know that too long a subjection to such heat will toughen and harden, not only the exterior albumen—which is good as preventing the emission of juices,—but will render the whole joint hard and difficult of digestion; therefore, by the exercise of thought she will deduce effect from cause, with the result of a well cooked dinner.

If I may be pardoned, one more illustration:—Tell a girl that in preparing root vegetables, such as potatoes, carrots, etc., she should peel them very thinly, she will probably think the advice is actuated by parsimony, and is unworthy of attention; explain to her that the greatest nourishment lies immediately

under the skin, and she will see the force of the instruction, and follow it intelligently.

From my experience of girls I should say it is hopeless to expect to interest or influence them by a string of axioms, however excellent they may be. What we want is to arouse their understandings and to make them think for themselves.

The prejudice which so often exists, for instance, against soup, is, I believe, mainly attributable to its faulty preparation. We all admit the superiority of our French friends in this department. With them no scrap is wasted; the careful housewife does not throw away the water in which vegetables have been boiled, and into which so much of the gluten and mineral properties have passed, but keeps it as a foundation for future use in the form of stock.

A wide field of usefulness lies before the district visitor, with the necessary tact and knowledge to give advice without giving offence. We must remember it is much easier to speak of things generally in a lecture or address than individally in the cottage. No woman likes remarks to be made on the dirtiness of her house, but if it can be explained that dust really consists of tiny particles of decaying matter, which are taken into the lungs with the air we breathe, she will see a good reason for trying to keep free from it. It is difficult, with due regard to the sensitiveness of the poor, to speak of the lack of personal cleanliness; but the importance of cleansing the surface of the body may well be urged on the score of health. As Miss Nightingale says, "even in the poorest homes a basin of warm water, a piece of soap, and a towel can be procured." And if we could impress on mothers the necessity of bringing up their children to practice the habit of daily ablution from their earliest life, it would become a second nature, and would conduce immensely to their health, happiness, and vigour.

Sir Edwin Chadwick gives us the following result of his experience on the subject:—"In one orphan institution the progress made by the application of sanitary factors was thus denoted: The death-rate amongst the children was 12 in a 1000. The impurity of the air was removed by better drainage, and the death-rate reduced to 8 in a 1000. A further advance was made by daily head-to-foot ablutions of the children with tepid water, and a complete skin cleanliness maintained, when the death-rate was reduced to 4 in a 1000." He further dwells on the economy of cleanliness, stating that the food that would be required for four children that are unwashed would serve five that are washed.

It is often impossible to obtain an adequate supply of fresh air in the crowded houses of the poor, even when we can

induce them to sleep with their bed-room windows partially opened; but with regard to cleanliness of the house, the person, and the clothes, very much is in the hands of the mother and the daughter of the family.

In conclusion, I would again reiterate that my aim in writing this paper is simply to induce other women to take advantage of the present opportunity the Congress affords us of acquiring knowledge for ourselves, and adopting suggestions as to the best means of distributing this knowledge amongst those outside the direct reach of the Congress teaching.

Dr. Richardson said, some years ago, at one of these meetings: "It is from the million centres we call the 'home' that sanitary science must have its true birth. It is from those centres the river of health must rise. We men may hold our Congress year after year, decade after decade; we may establish our schools; we may whip our lawgivers to action of certain kinds; we may be ever so earnest, ever so persistent, ever so clever; but we shall never move a step, in a profitable direction, until we carry the women with us heart and soul."

Could we not, with this end in view, endeavour to establish a Ladies' branch of "The Sanitary Institute" in this City and County, which might be productive of permanent results in the amelioration of the lives of those we would benefit, through that wide-reaching charity which gives to every human being in want, a claim on our sympathy and devotion?

On "The desirability of establishing a Sanitary Association in Worcester in connection with The Sanitary Institute," by HENRY HOWARD.

WORCESTERSHIRE, from a sanitary point of view, presents perhaps stronger contrasts than most other counties. Within its borders it claims Malvern, "the healthiest watering place in the kingdom," Droitwich, with a cure of immemorial fame, whilst it has to acknowledge whole districts where the lives of its working poor run on under conditions so unfavourable to health that each year in consequence hundreds sicken and die.

Statistics enforce these contrasts.

Malvern has a death-rate from zymotic disease of 1 in 8,000.

Some of the rural sanitary districts have also reasonably low death-rates.

But over the whole county the death-rate from zymotic disease, in spite of the effect upon the averages of the favourable instances above-mentioned, is nearly 15 to 8000 living, and the death-rate from typhoid alone is actually higher than in London!

These facts claim the attention of the skilled sanitarian, and require the application of advanced sanitary science.

Other papers read at this Congress are for the instruction of the members of the Institute and the public. In this I desire to be the mouthpiece of those who have come here anxious to learn where to find a remedy for this state of things, and to claim your assistance in their search for it.

The work to be done is a great and patriotic work, which, if carried through, should worthily and permanently record the fortunate visit of the Institute to Worcester—not only in its own "transactions," but in the hearts and grateful memories of those who now "groan and sweat under a weary life." These contrasts must cease: and we believe that not in vain shall we look to you for those valuable practical suggestions which will assist the attainment of this desired result.

Let us, in Worcester, join hands with you in London, either as a branch association, or in some other way as may seem best. Let the treasures of your science, the skill of your distinguished sanitary engineers, the devoted energy, the leisure of your learned specialists be united with, on our part, determination in the application of the provisions of the Public Health Act, and earnestness in making the most of the sanitary powers conferred upon the County Council; and thus by our joint efforts let us make Worcestershire the standard illustration of applied sanitary science, the ideal healthy county of England. Would not such a positive practical success secure for the Sanitary Institute the confidence of the enlightened intelligence of this country, and make it, with such a record, the most powerful and popular association of the day.

But accurate detailed knowledge is absolutely necessary as a condition precedent to action, and as a first step we appear to want a report by competent persons on the sanitary condition of the county, especially having reference to the condition, and sanitary arrangements of the dwellings of the poor in those populous places which have all the faults, whilst as yet possessing none of the organisation of small towns.

Such a report should deal with all public, and where possible, private sources of water supply, unhealthy conditions of employment should not be allowed to pass unnoticed, and the pollution of streams, and the disposal of sewage should claim attention. In many cases valuable facts would be found in

some of the excellent reports of the medical officers of health, though occasionally these reports confirm the proverb's truth, "A muzzled cat was never a good mouser."

Is not this first step, this report, within the compass of our united powers? The action that would follow its publication would hasten, if not attain, ideal sanitary perfection; but without such information to guide us, no progress can be made, and it can be obtained only by an organized, not by an individual effort. We are only at the commencement of the march of sanitation. True we may look back and count a few forward steps, some great successes; but the wisest cannot picture the grandeur of the age of perfect national health.

The fact that the annual mortality from zymotic disease in England during the past twenty years has been reduced by three-fourths may fill our hearts with buoyant hope, lovely as the rainbow on the dew of the spent thundercloud; yet the victory is not complete. Humanity is advancing but slowly over the vast mountain-barrier between the dismal land of needless sickness, and misery, and death, to the happy country of uninterrupted health. Far below us lie the forgotten terrors of the Black Death with its countless thousands, the gaol fever, taking its toll alike from judge and felon, and other hideous and fatal diseases born of want and neglect.

The work for our time is the passage of the torrent of zymotic disease, which, whilst we lag behind, annually claims its huge death-roll, and Worcestershire men, women, and children are daily swept away by its fatal current, and the health of many of those who survive is ruined for life, and the homes of those so visited wasted with poverty.

Our united efforts would surely hasten the day when we shall have done with preventable disease, when the damps of its chill breath will no longer be felt; when the last chasm passed, the fatal torrent crossed, the rocky barrier climbed, humanity under the guidance of sanitary science, will descend into that fair, and pleasant, and fruitful land, where each life may work out its purpose unlet by the dread, by the reality, by the regret of wasteful disease and untimely death.

Sir Douglas Galton, K.C.B., F.R.S. (London), said the Sanitary Institute had long had under its consideration to a certain extent the question of establishing affiliated Sanitary Societies. There had been a very definite proposal from The Manchester and Salford Sanitary Association with the view of forming a nucleus of Sanitary Associations for the whole of the country. The question involved a great many difficulties, and the Institute, having reconstituted itself so recently, had not yet been able to come to a decision on the subject.

But he confessed they would derive great advantage and strength if they could have affiliated societies to the Sanitary Institute in all the principal centres of population.

Dr. H. M. Page (Redditch) said he had had something to do with the vital statistics of a small area of the county of Worcester, and could enforce the view that those statistics, and certainly the zymotic and infant vital statistics, were nothing short of a disgrace to the county. He thought that now the County Council was able to consider its ways and means, one of the very first steps would be, as the writer of the paper suggested, to obtain and classify the county statistics for what they were worth. Fortunately there were in the county statisticians perfectly capable of sifting these figures, and he hoped they would be able to present to the Council a balance sheet of statistics, as it were, which might be of service to the Council in any steps it might take. No branch of vital statistics was more important than those of diseases which sanitary science had shown to be preventable. He thought the Councils ought to press the provision of hospitals where cases of infectious disease could be rapidly isolated. The adoption of the measure for the compulsory notification of infectious diseases was, unfortunately, in the provinces left permissible, not compulsory, but he hoped the Act would be brought into force throughout Worcestershire. He thought that with proper correction of statistics and the adoption of this Act, together with the formation of societies such as had been suggested, the Council would be able to nearly abolish preventable disease. He should be happy to furnish the Council with such statistics as he had.

Mr. G. J. Symons, F.R.S. (London), said, in regard to the remarks of Sir Douglas Galton, that a fearful amount of work had been entailed by the recent amalgamation. But as soon as the Congress was over they would find themselves in smoother water, and he would then be glad to support the line of action suggested by Sir Douglas Galton. There seemed to be an idea that the Sanitary Institute was a high and mighty and powerful body to which ordinary mortals could not expect to be attached. That was not the case. And they had also heard a great deal about ladies' associations, as if the Institute were entirely a masculine body. That was not so, for they had lady associates and lady members; there was no difficulty in gaining admission. If a few local people were to join the Institute, to receive the publications regularly and attend the meetings, they would act as a sort of nucleus round which a larger local body might be formed.

The Mayor of Worcester said he would be very pleased to co-operate with Captain Howard in his very excellent work. They were all agreed as to the desirability of branch associations, and he thought they would be able to devise some measure without much difficulty for affiliating associations throughout the country with the Institute. He did not think that becoming a member or associate of

the Institute was the same thing as having a local branch, which exercises much greater force and influence. By a local branch they would have a direct local personal and collective interest, and they would have locally the full benefit of the work of the Institute. In addition to that it would be a valuable recruiting ground for the Institute. He hoped the Council would shortly be able to see their way to carry out the scheme promulgated by Mr. Howard.

Mr. H. Howard (Kidderminster), in reply, acknowledged the offers of co-operation which he had received. He entirely agreed with everything that had been said as to the absolute necessity of ladies taking an interest in the work of sanitation, and he was particularly struck by the remark of the Mayoress, that if sanitary science is to make general progress the beginning of it must in each case be made in the home of the individual. He was there to speak on behalf of the people who were unable to speak for themselves, who were not represented there in any way, to ask for the assistance of the Institute in obtaining an accurate account of those parts of Worcestershire which are in a disgraceful condition, because this will influence the mind of the Council and result in action. Such a report should be the first object of a branch association, and if it had a definite object like that there would be no want of interest in its meetings. If a branch were established, however, to talk about everything under the sun having reference to health, the interest would very soon slacken, and in the fatal third year of which Dr. Strange had spoken the end would come. He hoped something practical would be done as the result of this discussion, and he thanked them all for the interest they had shown.

On "Co-operative Cooking, by a 'Society for Supplying the Poor with Cheap and Wholesome Cooked Food,'" by William Strange, M.D.

ABSTRACT.

The *plan* now to be briefly described has been in operation in Worcester for the past three years, and has proved so far eminently satisfactory.

The object is to supply the working classes with a kind and quality of food with which they are to a great extent unacquainted, and which, in most cases, they are totally unable to provide for themselves.

The principle to be kept in view in carrying out this object is to avoid pauperising the poor. The food is to be paid for at a price which will be, on a large scale, self-supporting, and, on a smaller scale, at least pay the cost of materials and of cooking the same.

The food is of the most nutritious quality that can be had, consisting chiefly of pea soup (including some animal food); suet puddings, with treacle, jam, or raisins; Irish stew; and, where desirable, a lighter kind of soup for young children. Cooking for the sick might be added.

The operation of the plan is carried out by establishing cooking centres in several densely-populated parts of the town, where the food is sold at mid-day *to all comers.* Children's dinners are also provided and consumed on the cooking premises at $\frac{1}{2}$d. and 1d. each.

The only charitable portion of the plan is carried out by the sale of tickets, 1d. each, to the clergy and others, to be distributed amongst the very destitute in severe weather.

The Mayor of Worcester said that it was necessary to supply the human body with food of the right character. Dr. Strange's paper had very ably illustrated the best class of food to be used for this kind of cookery. They knew Dr. Strange's zeal in this matter, his self-denying labours, and the very beneficial results which had ensued. The cheap dinners and the cheap breakfasts given in Board Schools had produced most sanitary results, inasmuch as the physique and tone of the school children had benefited considerably. He desired to add his testimony to the services Dr. Strange had rendered in this way in the city, and thanked him for bringing the subject forward.

Captain Locke (Worcester) said that from his long thirty-six years' experience as a sailor he believed the pea soup mentioned by Dr. Strange was the most nutritious and best fitted for use in that way. He might add that both passengers and crew always enjoyed the above three days in the week as part of their dinner. They always carried split peas, and used rain water if they were fortunate enough to catch any.

CONFERENCE OF MEDICAL OFFICERS OF HEALTH.

This Conference was jointly arranged by the Institute and the Society of Medical Officers of Health. A full report of the subjects discussed is given in "Public Health," October, 1889, pages 162—173.

SECTION II.

ENGINEERING AND ARCHITECTURE.

ADDRESS

By Henry John Marten, M.Inst.C.E.

PRESIDENT OF THE SECTION.

Introductory.

The subjects for consideration in this section — namely, Engineering and Architecture—although necessarily limited to their sanitary aspects only, cover a wide area, and present numerous and important features, each of which would be more than sufficient for the text of an address.

For instance, the works in connection with fen drainage, town and village sewerage, house drainage and domestic sanitation, water supplies and fittings, luminants in their sanitary aspects, building materials and methods of house construction, warming and ventilation, smoke abatement, and many other matters too numerous to mention, are all included within the limits assigned to this section, and you will probably have the opportunity of discussing some of them.

Although considering the extent of our information, and the light we now have with respect to sanitary matters, and the extent also of our opportunities, we have not much reason to boast of the progress we have made as a nation in practical sanitation, compared with what we might have made during the past 40 years; yet it may be permissible—in fact, it may be advantageous—to take a retrospect of some of the advances made during that period, and I invite you to do so with me for a short space of time.

Fen Drainage.

Amongst the subjects which I have named in my introductory remarks as within the range of those referred to us is that of fen drainage.

The sanitary influences of the works carried out in this department of engineering have, I think, been much overlooked, as those sanitary influences have been *incidental only* to the main objects of fen drainage works, which have been principally directed to the improvement of fen and marsh lands for pasture and other agricultural purposes.

From a sanitary point of view, this subject of fen drainage may not at first sight appear to be a large one, but considering that in the fen counties of Lincoln, Huntingdon, Bedford, and Cambridge there is a population of 850,000 persons, it is certainly worthy of attention.

During the past 40 years great improvements have taken place in this department of sanitary work.

The old windmill, with its irregular, inadequate, and imperfectly applied power, has given way to greatly improved pumping machinery actuated by steam, by which means the line of saturation has been kept at a much lower level than formerly was possible over large tracts of fen country.

The total quantity of land which has to be kept dry by pumping in the valleys of the Ouse, the Nene, the Welland, and the Witham rivers is about 455,000 acres. That acreage is equal to about 700 square miles, or equal nearly to the whole area of Worcestershire; and to show the improvements which have been effected in some parts of these fens, I find it stated in a paper by Mr. Lawrence Gibbs, which appears in Vol. XCIV., Part IV., of the Minutes of Proceedings of the Institution of Civil Engineers, that two fens, viz., Deeping Fen in the Welland Valley, and Littlepool and Downham Fen in the Ouse Valley, having together an area of nearly 60,000 acres, which were formerly kept "in a half-cultivated state" by means of 119 windmills, are now effectually drained by means of four steam engines.

The lowering of the line of saturation, or, in other words, the lowering of the underground water level effected by these improvements, has a most important bearing on the sanitary condition of those fen districts.

When the level or line of saturation is higher than the point below the surface of the ground which is affected by the heat of the sun, or when the level is within capillary range of the surface, large volumes of miasmatic vapours are occasionally

given off, which spread their depressing influences far and wide over the fen country.

When, on the other hand, the line of saturation is drawn down below the points named, the evolution of miasmatic vapours is greatly reduced; and with their disappearance, numerous forms of febrile and rheumatic complaints cease to exist.

Great sanitary advantages have resulted also from "The Land Drainage Act of 1861," in accordance with the provisions of which numerous Drainage Boards have been constituted under the authority of "The Land Commissioners for England," whose duties have now been transferred to the recently constituted "Board of Agriculture."

By their favour, I have been furnished with the information, tabulated below, which shows the wide areas over which the beneficial influence of the Land Drainage Act has been extended since it came into operation twenty-eight years ago.

Description.	Number.	Counties.	Area, Acres.	Amounts authorised to be borrowed for Works.
				£
(1.) Commissions of Sewers Recommended	12	6	28,811	40,250
(2.) Separate Drainage Districts Constituted	27	16	65,306	104,535
(3.) Thames Valley	..	..	55,472	71,450
(4.) Somersetshire Drainage Acts	..	..	109,529	66,550
			259,118	282,785

It will be seen, therefore, that "the Land Commissioners for England" have incidentally contributed to the amelioration of the sanitary condition of the inhabitants residing on no less than a quarter of a million of acres, or 400 square miles of country, by the constitution of numerous drainage districts, and by authorising an expenditure for carrying out carefully considered schemes for main drainage and other such works of more than a quarter of a million sterling. I say carefully considered schemes, because as one of their engineering advisers, I know how minutely every point is considered before any drainage district is constituted and before any works are authorised by the Land Commissioners.

The main drains of many old districts have also been greatly improved, by the lowering of the outfalls.

In one case, that of the Grand Sluice at Boston, the sill of

the new and enlarged sluice has been lowered 3 feet and the seaward channel 8 feet, thereby practically raising the level of 500,000 acres, or 800 square miles of fen-land considerably above the previous line of saturation.

There is no doubt that these great improvements have materially raised the sanitary status of all such districts, and have done much to minimise the physical disadvantages of fen-life.

In proof of this, Dr. Farr, in his "Vital Statistics" (pages 136 and 137) states, "The great land drainage works have had great influence in improving the health of the inhabitants of the Isle of Ely, as by their means the atmosphere has been purified and dried."

Again the same authority states that at Orsett, near Tilbury, in Essex, a remarkable reduction in the death-rate has occurred during the thirty years, 1841 to 1870, "partly due to sanitary improvements, but mainly to the drainage of the land and consequent dryness of the soil."

He also states that, in three fen districts in Cambridgeshire, namely, North Witchford, Whittlesea, and Wisbeach, containing an aggregate population of between 50 and 60 thousand persons, the death-rate, in the thirty years between 1841 and 1870, has been reduced from $25\frac{2}{3}$ to $20\frac{1}{3}$ per thousand, or nearly 20 per cent.

He also states that in Wisbeach, the deaths from phthisis were reduced from 2 per thousand in the ten years, 1851-60, to 1·6 per thousand in the ten years, from 1861 to 1870—or 20 per cent.; whilst at Orsett deaths from the same cause were reduced in the same periods, from 2·8 to 1·9 per thousand, or 32 per cent.

Town, Village, and House Drainage.

Passing from the subject of fen drainage, I now propose to make a few remarks on the improvements which have been effected, during the past forty years, in town, village, and house drainage.

I remember the early reports of the Sanitary Inspectors of what was then termed the Board of Health, as to the state of things forty years since, with regard to these subjects.

The reports disclosed, as then almost universally existing, a most horrible state of affairs, which is now, happily, only exceptional.

Open and almost stagnant sewers in close proximity either to the front or back doors of rows of houses, and, whilst festering there, giving off large volumes of poisonous gases.

Leaky dumb-wells, sunk in porous ground, receiving the sewage from large numbers of houses, with the pumps for the supply of the said houses drawing their water from shallow wells sunk in close proximity to those dumb-wells.

Drains, where they did exist, untrapped, and through which at night, when all the doors and windows in the houses were closed, the only supply of air for the inmates could be obtained.

Sewers, properly described as only "elongated cesspools," much too large for the work to be performed, constructed in many cases of porous materials, of very unscientific section, and with but little regard to gradient.

No one whose memory does not carry him back to that period, can now conceive of the amount of ignorant and selfish opposition, which Mr. (now Sir Edwin Chadwick, K.C.B.) encountered, when, acting as Secretary to the Board of Health of that period, it became his duty to call public attention to this state of things, and to suggest the remedies for them.

Obloquy was thrown upon everything he said or did in connection with sanitary matters. The facts as to the existing sanitary abominations which he had carefully collected and marshalled, were either boldly denied, or defended as at least necessary evils. Every vested interest, from the night-soil man to high municipal functionaries, was against him, and had he not been as patient as Job, and as callous to adverse criticism as the pachydermatous monster, described in the poem of which that patriarch is the hero, was to spears and arrows, he could not have accomplished the great sanitary revolution which has been his life work, and to which this generation is so much indebted.

I had the pleasure of making his acquaintance during the period when he was battling for sanitary reform against all these adverse influences, and I feel it one of the greatest honours of my life that the friendship then commenced has been continued up to the present time without break or interruption.

One of the great difficulties with which Sir Edwin Chadwick had to contend was the then existing idea that every sewer must be a "Cloaca Maxima."

Classical gentlemen when visiting Rome were shown that sewer amongst the other antiquities of the place, and being in the humour to fall down and worship any work of the imperial and practical Romans, they, of course, fell down and worshipped that particular work, which was all very well in its place, but which was not adapted for the universal and indiscriminate application which they made of it.

If this worship had been in the nature of a "silent culte" it would probably have done very little harm, but, unfortunately,

the worshippers were zealous to make proselytes, and everywhere preached the doctrine of large sewers—"nothing smaller than such as a full-grown man could walk upright in,"—and, in fact, everywhere and for all sewage purposes, "Cloaca Maxima, Cloaca Maxima," was the cry.

Proselytes were, of course, soon made amongst the classical architects who had copied the buildings and smelt all the unsavoury odours of Rome, which ought not to have existed had "Cloaca Maxima" been all that highly poetic fancy had painted it; and when they returned to England and received commissions to build or re-build some of the stately mansions of our country gentlemen, they commenced operations by making large cavernous "Cloacæ Maximæ" under and about the foundations—easily satisfying their clients that all was perfection by reminding them of their early studies, and of the great name and glory of the "Cloaca Maxima;" with the unhappy consequence, that, for some *then* inexplicable cause, notwithstanding situation and every advantage of pure air and good water supply, the dwellers in the finished mansion were always victims to some form of the numerous complaints which we *now* know to be due to the presence of "sewer gas."

To show that I am not exaggerating, I may state that not long since I had to inspect a nobleman's house in one of the midland counties, which only 30 years since had been sewered by a leading London architect on the "Cloaca Maxima" principle. Within the last two or three years the house in question had become almost uninhabitable on account of the presence of sewer gas, traceable to these large sewers; and besides the health of the in-dwellers, a rental of several hundred pounds per annum, was placed in jeopardy.

This led to the doing away with the old-fashioned "Cloaca Maxima" under the building, and the introduction of the modern small pipe sewer and fittings, and the house is now free from that insidious guest—sewer gas.

I have mentioned the part taken by architects in the spread of "Cloaca Maxima" worship, and lest they should deem me unfair in singling them out, I am about to confess that engineers, after admiring the bridges, roads, and aqueducts of the old Romans in all parts of their empire, and especially the splendid remains of those works in Italy, were, like the architects, also smitten with the same unhappy disease of "Cloaca Maxima" worship.

It is needless to say that builders and contractors saw no reason to quarrel with "Cloaca Maxima" specifications which made domestic sewerage works "jobs worth doing."

Shortly after the advent of Sir Edwin Chadwick, however,

"Cloaca Maxima" worship received more of that gentleman's attention than its worshippers altogether appreciated; and after being severely wounded in several vulnerable points by that veteran sanitarian, this form of worship was, after a severe struggle, finally and ignominiously done to death in, I believe, a backyard in Westminster.

The way of it was this. Some practical but scientific sceptics one day took a peep into one of the old-fashioned metropolitan "Cloacæ Maximæ."

To their astonishment they found more than four-fifths of the sectional area of our "Cloaca Maxima" filled with putrid mud, over the top of which a little stream of gas-bubbling sewage was dribbling along; that is, they found the boasted "Cloaca Maxima" to be nothing more than a putrid mud trough with a trickle of sewage passing through it.

Having digested this fact, they bethought themselves of trying what would happen if this trickle of sewage were passed through a small glazed earthenware pipe.

Pursuing this inquiry in a methodical and practical manner, a length of such small earthenware pipe was laid down, and the "Cloaca Maxima" quantity of the sewage was poured down its throat, and to everybody's astonishment the little "earthenware pipe" accomplished not only all that "Cloaca Maxima" did, but even more—for it not only freely discharged the whole of the sewage passed into it, but left no festering sediment behind in the pipe.

Here was a great fact established, namely, that a small glazed earthenware pipe, laid at the same gradient as "Cloaca Maxima," could not only discharge all the sewage usually passed by its big brother, but was, in addition, "self-cleansing"—that is to say, it not only left no sedimentitious matter in it, but removed any extraneous matter purposely placed therein.

Now began the battle between the "Cloaca Maxima" principle and what in derision was termed the "pot-drain," and a right royal battle it was.

Architects, engineers, and builders were at first almost universally on the side of "Cloaca Maxima," whilst "pot drain" was supported by Sir Edwin Chadwick, backed only by stubborn facts.

However, after a hard struggle little "pot drain" gained so complete a victory over "Cloaca Maxima" that even its greatest devotees were eventually obliged to discard it as both a costly and dangerous specimen of antiquity.

This is the early history of our present system of sewage removal by water carriage, and so complete has been the revolt from the "Cloaca Maxima" principle, that I may mention as an

instance of its discomfiture, I have for several years past, without stoppage or inconvenience, been passing by gravitation, up hill and down dale, the whole of the sewage of Dudley, a town in this county, containing nearly 30,000 inhabitants, through a pipe five miles in length and only 13 inches internal diameter.

Sewage Disposal.

It was soon found that the more perfect system of "pot pipe" drainage brought down to the outfalls not only a larger quantity of sewage than came down under the old system, but that the sewage was of a much more concentrated description.

The reasons for this were that under the "pot" system there was much less leakage into the subsoil, there were no sedimentary retentions, and there was a much more detailed collection than under the old "Cloaca Maxima" system, and these circumstances combined to give great urgency to the question as to what was to be done with the sewage on its discharge from the outfalls; and I remember the great battles which have raged, and which in fact are now raging, about the vexed question of sewage disposal.

The chemists were good enough to make the first attack upon the solution of this question, and dazzled our imaginations with "el dorado" calculations as to the manurial value of sewage deposit, when dried and manipulated according to their respective nostrums, so that the impression began to gain ground that all municipal rates and taxes would eventually be paid, and something over, out of the sewage-discharge of the urban localities.

Great, therefore, was the chagrin and disappointment when sewage manure company after sewage manure company had to be wound up, with assets consisting only of old bricks and mortar hardly sufficient in value to cover the auctioneer's expenses of their sale.

Then came the age of sewage farms and broad irrigation, and a large number of the leading municipal bodies purchased extensive tracts of farming land upon which to dispose of the sewage, and they thus acquired a sympathy with the great agricultural interests of the country, of which they had had no previous experience.

I am sorry to say that the experience these bodies thus acquired introduced them to those aspects of the agricultural question which are charged with originating the habit of "grumbling."

After the first few years everything appeared to be against sewage farms.

In manufacturing towns the farming operations had to be conducted with sewage largely mixed with corrosive acids, upon which acids it was found that neither cabbages nor rye grass would thrive. Actions were being prosecuted on all sides for damages for the pollution of the streams into which the effluent was discharged—as at certain times and seasons neither the land nor the vegetation could take up the whole of the effluent—some part of which had to be discharged raw into the streams.

In other cases actions were commenced to put a stop to the nuisance occasioned by noisome smells emanating from the farms and poisoning the atmosphere for long distances round. The farms were all found to be on too small a scale, and became "sewage sick," and additional land had then to be purchased at much more than ordinary agricultural value; and to cap all, the annual balances were almost universally on the wrong side.

After a few years' experience it was also found that raw sewage, containing all the sediment that was previously deposited in the old elongated cess-pools, was of a very clogging nature, and that in a short time it completely stopped all aëration to the roots of the plants; and that it was, therefore, difficult for them to thrive so well as in natural soils.

Various devices were adopted to overcome this last named evil, such as "intermittent downward filtration," by which system during one day the roots of the plants received a dose of sewage, and the next a dose of air.

These devices were adopted with varying degrees of success, but on the whole they failed to fully cure the evil; and at last it occurred to someone to try to precipitate the matters held in suspension out of the sewage, and only to run the clear effluent over the land.

In the first instance mere sludge tanks were adopted, with rough strainers, through which the sewage flowed at a slow rate so as to allow of the heavier matters being deposited in them, but these arrangements were found to be insufficient.

Lime and chemicals were afterwards added, which greatly aided the precipitation in the tanks, and another great stride was made by the adoption of "quiescent," instead of what were termed "flowing tanks," with a marked improvement in the effluent.

Under the quiescent system originated by the late Mr. James Lomax, of Bolton, the sewage when mixed with the chemicals was allowed a period of perfect rest in the tanks, and thereby the action of the chemicals became more rapid and effective. A further improvement was also effected by drawing off the effluent periodically from the upper portion of the water in the tanks.

The effluent when passed direct into streams from these precipitating tanks was however found, if alkaline, to set up a secondary fermentation, to prevent which the effluent water was passed over a small area of land, and the sludge was utilised as a sort of top dressing to surrounding land, or taken away by farmers as back loading.

The plan last described is that now generally being adopted, and all those interested in the question of effluents are turning their attention to the discovery of some cheap precipitant that shall render the effluent from the precipitating tanks clear and bright, perfectly innocuous to fish life, good as an irrigator when so required, and incapable of secondary fermentation. I think it not improbable that some such material, or combination of materials, may be found before long; in fact, some people are under the impression that it is already discovered, and, if so, then, with sufficient land for precipitating tanks and sludge deposit, we may congratulate ourselves that the sewage difficulty has become a thing of the past,—except in regard to a little item which, I fear, must always be present, and that is "annual cost."

The above is a sketch in outline only of the sewage disposal struggles of the last 40 years, so far as they relate to water carried sewage.

The sketch is necessarily devoid of detail, and it has only been possible to give the more salient features of the retrospect.

Much has still to be done before we can say we have approached perfection; but as every successful effort means thousands of lives either saved or prolonged, we all can only wish God speed to all patient and faithful workers in this department of sanitation, whether their efforts are directed to perfecting the "water carried" or any other system of "sewage treatment and removal."

Very great progress has been made during the past forty years in the details of the fittings for house drainage; and, as our successive exhibitions show, every year is adding to the perfection of domestic sanitary appliances.

They are, in fact, now so perfect, that there is no reason why every house in the kingdom should not be fitted with apparatus which would place it beyond suspicion of any want of proper sanitation; and I am glad to learn that, under voluntary examining associations, even the much-abused plumber is becoming an intelligent and skilled graduate in sanitation.

With some bright exceptions, the improvements in the sanitary conditions of our villages have, unfortunately, not kept pace with those connected with domestic drainage appliances,

nor with those in urban districts; but the medical officers of the rural authorities are fully alive to the sanitary defects of their districts, and are doing good work in continually pointing them out; and I am hopeful that the large sanitary powers now at the command of County Councils will be put in force with advantage in those districts, and that in the course of a few years good results will follow.

In the report of the Sanitary Committee to the County Council of the County of Worcester, dated May 18th, 1889, and signed by Sir Douglas Galton as chairman, the following are set out as provisions of the Local Government Act, 1888, having reference to the powers, duties, and liabilities of the Council with respect to matters bearing on *Sanitation*, namely:

(*a*) The appointment, removal, and determination of the Salary of the Public Analyst [L.G. Act, § 3 (x)].

(*b*) Rivers Pollution Prevention Act, 1876 [L.G. Act, § 14].

(*c*) The making of Bye Laws for prevention and suppression of Nuisances [L.G. Act, § 16].

(*d*) The appointment of a Medical Officer of Health [L.G. Act, §§ 17, 18 and 19].

(*e*) Payments in substitution for annual local grants [L.G. Act, § 24], namely:

(i.) To the Guardians of Unions for payments to Public Vaccinators [L.G. Act, § 24 (2) (a)].

(ii.) To the Local Authorities, one-half of the Salary of the Medical Officers of Health and Inspectors of Nuisances [L.G. Act, § 24 (2) (c)].

(iii.) To the Guardians of Unions towards the remuneration of the Registrars of Births and Deaths [L.G. Act, § 24 (2) (d)].

(iv.) In respect of the maintenance of Pauper Lunatics [L.G. Act, § 24 (2) (e) (f) (g.)].

In accordance with these powers the Sanitary Committee, presided over by Sir Douglas Galton, recommended that a legally qualified Medical Officer of Health should be appointed for the county, who, under the control of the Sanitary Committee, should have a general supervision of all sanitary matters arising in the county, and who should not hold any other appointment nor engage in private practice.

The report also recommended as important that immediate steps should be taken to enforce "The Rivers Pollution Prevention Act, 1876," in relation to the streams within the jurisdiction of the Council, and that the several County Councils in the water-shed of the Severn should be requested to concur

in a representation to the Local Government Board to constitute a joint committee for that purpose.

By clause 19 of "The Local Government Act, 1888," every District Medical Officer is bound to send to the County Council a copy of any periodical report which he is now required to send to the Local Government Board; and in the event of its being found, from any such report, that "The Public Health Act, 1875," is not being properly enforced in the district, or that any other matter affecting the public health of the district requires to be remedied, the County Council may cause a representation to be made to the Local Government Board on the matter.

Under this clause the eyes of the County Council, as regards sanitary matters, will be everywhere, with a statutory authority, by means of a representation, to call to its aid all the resources of the Local Government Board to remedy any sanitary defect.

By these clauses the County Council is now made an important unit of centralization with regard to all sanitary matters arising within the county, and consequently a much closer and more detailed investigation into sanitary evils is likely to be attained than was possible under the old system, in which the Local Government Board was practically the only centralized authority.

Water Supply.

With your kind permission we will now turn for a few minutes from the somewhat odorous subject of sewage to the sweeter one of water supply, though on looking back I can remember the time when some towns in England were supplied with a mixture very little better than raw sewage, and certainly inferior to some of the clarified and purified effluents of modern times.

At one time, within my memory, a large portion of the metropolis was supplied direct from the lower reaches of the Thames, between Battersea and Vauxhall bridges, with a liquid which at times could only be described as "unadulterated cholera mixture;" and I remember, as a young engineer, going to see a large Cornish pumping engine, just then erected by one of the London water companies for supplying its district with water pumped direct from the Thames, at a spot not more than half a mile below where, what was then termed the Ranelagh sewer, which drained Chelsea and other densely-populated parts of London, emptied itself into the river on the opposite side from the engine.

Public opinion, aided by the outbreaks of cholera, and the

fear of renewed attacks of that scourge,—with respect to which a glimmering notion was dawning upon the public mind that these attacks of cholera had some connection with the want of proper sanitation,—together with the continual bombardments by the Board of Health, ably directed by Sir Edwin Chadwick and his medical staff on all such abominations as unfiltered—between bridge Thames water supply—gradually brought about a better state of things, which in some cases had already been effected in the provinces, and the example set by which, London was urged to follow, namely:—

(1) To avoid originally contaminated sources of water supply.
(2) To filter all supplies derived from surface sources.
(3) To give a constant supply.

In accordance with the first named requisition, the intakes of the Metropolitan Companies were removed higher up the river, beyond the reach of contamination from the London sewage.

The filtration of river water was gradually introduced, but so little was then known of the now common art and mystery of filtration on a large scale, that we had to go to some small works supplying a town in Scotland for our first practical experience on this subject, and the little sand filter there, only a few square yards in extent, is the parent of all the filter beds, upwards of 100 acres in extent, through which the 150,000,000 gallons of river water daily required for the supply of London are filtered, in addition to innumerable filter beds connected with provincial water works.

There was not much controversy about the question of filtration, as its merits were soon appreciated; but a very great fight raged for a considerable period about the question of constant supply.

From time immemorial the supplies given by water companies, with very few exceptions, were, in what was termed "the intermittent system," that is, the water was turned on for an hour or two a day only for each particular street.

The supply of water for the 24 hours had consequently to be caught and stored in tanks, butts, or tubs, or other such receptacles, in which, if originally pure, it frequently became foul and contaminated with surrounding abominations.

This intermittent system involved not only great inconvenience to the consumers, but, from the circumstances above named, was the cause of a large amount of illness; and again the Board of Health, directed by Sir Edwin Chadwick, came to the front and dealt some heavy blows at this antiquated and inconvenient system.

At the time when this controversy first broke out, I happened to be a pupil of one of the leading Metropolitan Water Engineers, who unfortunately held very strong opinions adverse to the system of constant supply, and he upheld the system of "intermittent" supply as perfection. In fact, he went so far as to say that the constant supply system on a large scale was "impossible," and he wrote a pamphlet to prove it, and for any one in his office to hold the shadow of an opinion in favour of the "constant supply" system was, as you may easily suppose, "flat treason."

In reply to this pamphlet, Sir Edwin Chadwick showed that so far from the constant supply system being the impossible theory it was represented to be by the engineer who was so strong a supporter of the intermittent system, it had actually been long in operation on a large scale in Nottingham, the water works in which town were under the able management of a rising young engineer named Hawksley—whose name, as that of a sound and practical engineer has since become of world wide reputation, and of whose works the Faithful City in which we are now assembled has some good examples, and will probably have more.

Amongst the water works originally constructed by the engineer who so strongly advocated the intermittent system, whilst I was a pupil of his, were those at Wolverhampton, in the adjoining county.

These works were constructed on the very strictest principles as a "model intermittent supply" water works, and it became my lot not only to superintend their construction, but to have the management of them placed in my hands after their completion.

For two years I struggled on with the intermittent system, but could make very little progress, as the fittings connected with that system were expensive, and consequently deterred people from having a supply from the water works, and altogether the inconveniences were such as not to encourage domestic consumption.

Under these circumstances, with the sanction of the directors, I made the necessary alterations in the works—which were not of an expensive character—and we commenced giving the supply on the "constant system" in the year 1849, or just forty years ago, since which time the works, which have passed into the hands of the municipal authority, have grown and extended until now they are supplying 120,000 persons on the constant system, and have a revenue of £23,000 a-year—that is to say, an annual revenue nearly equal to the capital originally embarked in the undertaking.

The conversion of the Wolverhampton works from "intermittent" to "constant" supply happened to come to the knowledge of Sir Edwin Chadwick through Sir Robert Rawlinson, then one of the engineering inspectors under the Board of Health, and I was requested to make some experiments as to the hourly consumption in Wolverhampton under the constant system.

These experiments showed that instead of having to provide pipes of a magnitude sufficient to afford a supply of water to every customer at the same time (as had been argued by the upholders of the intermittent system) they need not be larger than sufficient to supply the whole consumption of the twenty-four hours in about nine hours, and in fact that the distribution pipes might be made with safety somewhat smaller than had been the practice under the "intermittent" system.

These facts were brought out in evidence which I gave before the Board of Health in 1850, and also shortly afterwards before a Parliamentary Committee on Metropolitan Water Supply which was presided over by the late Sir James Graham.

The evidence given before this latter Committee settled the question as to the feasibility and advantage of the "constant supply" system, and there has since been no controversy worthy of the name in favour of the "intermittent system."

I should also remark that whilst forty years since it was stated to be an impossibility to give a constant supply on a large scale, now nearly $3\frac{1}{4}$ out of the $5\frac{1}{2}$ million of inhabitants within the limits of supply of the Metropolitan Water Companies are enjoying the advantage of a supply on that system, whilst in the provincial water works it is almost universally adopted.

The Severn.

Before leaving the subject of water supply, I should like to be allowed to touch upon a question a little nearer home.

You will all be aware that the city of Worcester is situate on the banks of a magnificent river named the Severn, which has its origin far up in the Welsh mountains, and which after flowing thence through Shrewsbury, Bridgnorth, this city, Tewkesbury, and Gloucester, empties itself into the Bristol Channel. And if before coming to the sanitary points which I wish to bring out, you will allow me to digress for a moment, I may remark that this river can boast of having had the first iron boat float upon its fair bosom, and of having been spanned by the first iron bridge ever constructed, a bridge which is still in existence, and which has given its name to an extensive district in Shropshire.

Within the last forty years a considerable length of the river has been redeemed from a state of nature, and has been canalised, under Parliamentary powers granted to the Severn Commissioners, by the construction of locks and weirs between Gloucester and Stourport, a distance of about forty-two miles, and by means of which improvements, goods and merchandise to the extent of about a thousand tons a day are now carried upon it by vessels of from 30 to 150 tons burden.

The spirit of enterprise is, however, not yet satisfied with this achievement, and further improvements are in contemplation, having for their object the provision of a sufficient navigable depth to enable sea-going steamers of from 300 to 400 tons burden to navigate the river up to the Quays in this city, that is to say, to within 30 miles of the very heart and centre of England.

From an investigation which I have recently been called upon to make as Engineer to the Severn Commissioners, I find that the cost of this great inland navigation improvement will be comparatively small, and I trust that most of us may live to see the day when vessels of this description may be found daily plying between Worcester and foreign ports, and so that, practically, Worcester may become the sea port for the great manufacturing interests which have their seats in this and the adjoining county of Stafford.

Let this suffice for the little digression for which I craved your indulgence.

I mentioned just now that the Severn has its origin in the far-off Welsh mountains, upon which the annual rainfall is very heavy; and some eight or ten years since the Corporation of Liverpool, casting about for an increased supply of water for their city and its numerous dependencies, bethought themselves of these Welsh hills, the rainfall on which supplies a large proportion of the water passing down the Severn, and they applied to Parliament for power to construct a large collecting reservoir on an upland tributary of the river named the "Vyrnwy."

The reservoir was intended to be on a large scale, that is to say, it was intended to have an area of over 1,100 acres, a depth of more than 70 feet in some parts, and to hold 13,000 million gallons of water.

The drainage areas or collecting grounds proposed to be appropriated extended over 23,000 acres, and represented about one-ninth of the whole upland range of Welsh hills, whence, as before stated, the larger proportion of the water supplying the Severn is derived, and whence comes by far the largest proportion of pure water passing down it.

In the event of such contemplated works being carried out it became important therefore, not only *per se*, but as a matter of precedent also, that the Severn interests, especially in their sanitary aspects, should be protected by its being made compulsory on the Corporation of Liverpool to deliver an adequate supply of compensation water into the river from the intended reservoir.

I am happy to say that Parliament took this view, and the compensation to be given from the one-ninth of the Welsh Hill water-shed appropriated to Liverpool, is on such a scale that in the event of the other eight-ninths being hereafter appropriated for the sanitary requirements of the metropolis (which has given indications of looking in this direction,) or any other places, there will at all times be at least 100 million gallons of pure Welsh Hill water passing each day under Worcester Bridge, and at times a much larger quantity.

The basis upon which the delivery of this compensation water was settled is somewhat peculiar, and it may therefore be mentioned here possibly with advantage.

There is in the first place a uniform and constant discharge of ten million gallons a day from the reservoir into the river, and in the second place an additional discharge of forty million gallons a day for four days in each of the eight months between the last day of February and the first day of November in each year.

The reservoir is now practically completed, and the water was commenced to be impounded in it on the 28th November, 1888, since which date the statutory quantities of daily and monthly compensation water have been regularly discharged from it.

The reservoir is now filled to within between eight and nine feet from top water line or overflow level, and after having duly provided for the compensation water discharged into the river, amounting to over 4,000,000,000 gallons from the date named, there remains for the use of Liverpool about 11,000,000,000 gallons within the reservoir.

I look upon these flushes of pure Welsh Hill water during the summer months as a valuable sanitary advantage to the river, and it is for this reason that I have mentioned them.

These flushes also being in the nature of small freshets, are of great advantage to the fish life in the river, and especially to the salmon, in connection with which fish the Severn now takes first rank in quantity as it has long done in quality, and the interests in connection with which are worth over £20,000 a year.

Whilst still on the subject, I should state that daily records

of the height of the water in the river, of the direction of the wind, and of the temperature of the air and of the water in the river, are being and have been taken during the past three years; and as time passes on, they will form a valuable record for comparative purposes.

These particulars are recorded at various stations extending from Portishead, on the Bristol Avon, to the Reservoir on the River Vyrnwy, a distance of 200 miles measured along the river, and they are collated annually, and printed for public information, by the Severn Fishery Board.

Some interesting facts are being brought to light by these records, one particularly for which I was not prepared, namely, that, except under some special circumstances, the temperature of the water in the river is higher than that of the air, a fact which opens up several questions of scientific interest.

Building Materials, &c.

Having already detained you too long on the matters to which I have ventured to refer, I will leave it to others, more competent to do so, to deal with the architectural portion of the subjects referred to in this section. The question of the architectural progress of the past forty years forms too wide a field for me to do so in this address. I will only remark that it has undoubtedly been very great, especially in regard to the dwellings of the poorer classes.

This improvement has been greatly encouraged by the removal of the duties on building materials which has taken place during that period.

Good drainage and pure water supply were then quite the exception for this class of house, and who can picture to himself the discomfort, disease, and premature deaths which the absence of these requisites caused in the houses of the working classes —a large proportion of which were constructed without back doors or windows, and without any means of through ventilation?

Now in many cases we not only see the comfort and health due to good drainage and good water supply, with better ventilation and larger spaces, consequent on better and cheaper building materials, but, in addition, some not unsuccessful attempts at ornamentation.

With respect to this latter point, I should remark that it has taken nearly a whole generation to get rid of the art-depressing influence of the exciseman in the brickfield, and we are now only beginning to realise the ornamental capacities of our brick-earths when properly blended, moulded, and burnt.

The advent of the exciseman reduced the tasteful artist in brick-earth of Queen Anne's time to the status of the unartistic manufacturer of common "stocks," 9 inches by 3 inches by $4\frac{1}{2}$ inches, and who gradually descended into a low class of "artful dodger," the highest ambition of whose life appeared to be to outwit the representative of the Excise Law.

We should be thankful that we live in times which have enabled us to dispense with taxes on building materials and on the windows which let light and air into our dwellings, and in which we are freed from the hateful presence of the exciseman in the brickfield. Art cannot exist where he is Lord paramount, nor under such peremptory codes as the stringent regulations of my Lords of the Board of Customs.

I have now dwelt upon some of the improvements in sanitary matters of the last forty years—but how much has yet to be accomplished!

How is it that in almost every newspaper we open we find accounts of outbreaks in some place or other of typhoid or scarlet fever, or some other ailment preventable by proper sanitary arrangement?

How is it that our death-rate still shows so high a range of mortality, especially amongst the young children of the poorer classes?

One could go on with a string of such inquiries *ad nauseum*, but I will not weary you, except to say that the work of sanitation still remaining to be done is of colossal proportions.

All honour, therefore, to those who without hope of reward devote their skilled intelligence to the improvement of the sanitary state of their surroundings, for in more senses than one such people are "the salt of the earth!"

Smoke Abatement.

Before concluding this address I wish, with your permission, to call attention to one subject in which during the past forty years we appear not only to have made no improvement, but in respect of which we appear, to some extent by force of circumstances, to have lamentably receded.

I refer to the non-consumption of the smoke made by our domestic fires.

The awful example in this respect is, of course, London, the grimy smoke of which, issuing from 600,000 to 700,000 kitchen chimneys, turns day, in certain states of the atmosphere, into midnight darkness—in fact, into more than midnight darkness, for in ordinary midnight darkness we can generally manage to

see a few stars overhead, whilst in the darkness created by the smoke from the domestic chimney we can only painfully grope our way from one faintly glimmering gas light to another, whilst overhead everything is cimmerian.

There have been great heart searchings with respect to this evil, and many suggestions have been made as to its cure, but, hitherto, without success, as we are still the slaves of the "blacks," which blind our eyes, which fill our nostrils and lungs, which dirty our clothes, which duplicate our death-rate during their distressing presence, and which, like the plague of frogs in Egypt, enter our chambers and profusely decorate our beds and furniture with their loathesome digits, and which finally, with their sulphureous impregnations, reduce all our books and papers to a mummy-like condition.

I find from the return of coal, culm, and cinders published by the authority of the Corporation of London, that the quantity of these materials brought into the London district by railway, canal, and sea during the year 1888 was 12,533,088 tons; and deducting the quantity shipped coastwise and exported from the Port of London during that time, which, according to a return obligingly furnished to me by the Board of Customs, amounted to 273,134 tons—and making a large allowance for bunker coal and coal consumed in the outlying districts of the metropolis—I consider the consumption proper to London is certainly not less than 11,000,000 tons a year, that is about 30,000 tons a day on the average. This is rather more than the whole annual produce and consumption of the South Staffordshire and East Worcestershire Mining Districts, known, emphatically, as the "black country."

In the year 1884 the quantity delivered into the London district was 11,140,576 tons, as against 12,533,088 tons delivered last year. This shows an increase in the quinquennial period, 1884—1888, of 1,393,512 tons, or an increase at the rate of 278,702 tons per annum during that period.

Probably one-third of the total estimated annual consumption of 11,000,000 tons takes place in manufactories, which, by law, are bound to consume their own smoke, and in which that operation is to some extent accomplished; but fully 20,000 tons a day on the average will be piled on the domestic fire, the smoke from which is still a legalised nuisance.

During the four winter months in the year, the domestic consumption will probably reach 30,000 tons a day, and with the ever-increasing number of domestic chimneys within the metropolitan area—estimated at about 15,000 a-year—this consumption of fuel must also ever be an increasing quantity.

To give some idea of the size of the coal-scuttle necessary to

provide for one day's consumption of coal in the domestic grates of London, it would, in winter time, have to be large enough to hold a lump of coal one acre in area, that is about 300 feet long, 150 feet broad, and 30 feet thick; and it is a lump of coal of that magnitude which, in winter time, is daily reduced in the metropolitan domestic grate to ashes and—*smoke*, and adding the consumption in manufactories, the block would have to be of the same length and breadth but 40 feet thick.

I have not seen any calculation of the numbers of cube miles of smoky atmosphere which would be produced by the combustion of such a lump of coal, but you can easily understand that it would be very great, and that in a still and foggy atmosphere the volume would be concentrated in the disagreeable manner which ends in dense darkness.

Possibly as electricity gradually takes the place of gas as our domestic luminant, the Gas Companies may more than heretofore turn their attention, as suggested by the late Sir William Siemens, to the production of heating gas; and this description of gas, which is of great calorific, but little illuminating power, may take the place of the domestic coal-scuttle, and so bring the production of smoke more under control.

There are, however, dangers to be guarded against, even should the time come when, by such a gas, the domestic coal-scuttle and all its disagreeable contingencies have been banished.

The principle one arises from the fact that the products of combustion evolved by the burning of such gas are only capable of floating in the atmosphere when heated to a temperature of 300° Fahrenheit, and, consequently, the moment they leave the chimney tops they begin to cool, and so, falling below the temperature of equilibrium, they would sink to the ground in still air; and thus, whilst we might escape the Scylla of being suffocated by smuts, we might not be able to escape the Charybdis of being poisoned by carbonic acid gas descending into the narrow streets, courts, and alleys of the metropolis.

The question is full of difficulties and still awaits solution.

The Smoke Abatement Institution has done good service in collecting information on the subject, and in testing various appliances; and the interest of inventive genius in the question is so great, that during the past 10 years three patents relating to it have, on the average, been taken out for every two working days during that time.

I have no suggestion to make for dealing in detail with this question, which is daily becoming more and more urgent, not only with respect to London, but with respect also to many of our larger towns, where great numbers of domestic chimneys

are congregated around and amongst coal burning works and factories.

I anticipate, however, that before long the evil will become so intolerable, that it will be dealt with in a very summary manner, by bringing the smoke issuing from the domestic chimney under the same regulations as those for smoke issuing from factory stacks, and until this is done, I doubt whether the individual householder can be brought to attack the question in the only way likely to bring about results on a scale beneficial to the community at large.

Concluding Remarks.

I have now only to apologise for having detained you so long, and to thank you for the attention with which you have favoured me.

We have travelled together along the border lands of the many subjects touched upon in this address—principally engaged in taking retrospective views—though occasionally looking around upon the subjects which are exciting the interest of sanitarians to-day, and now and then taking a not unhopeful peep into the future, which, judging from the diligent and intelligent workers who are now entering the arena, will, I anticipate, be of a much more rapid and brilliant character as regards sanitary progress, than it has been for those who must soon leave it, although the struggles of those who have laid deep and solidly the foundations of sanitary science and practice will always be worthy to be held in honourable remembrance, however brilliant the careers of their successors may be.

The President (Mr. G. W. Hastings) moved a vote of thanks to Mr. Marten for his most instructive and interesting address. Mr. Marten had alluded, from his own experience and knowledge, to the effect produced on the health of a population by fen drainage; and he was sure they would allow him (the speaker) to refer to a statement that was made by his father, Sir Charles Hastings, now twenty-five years ago, on the effect which had been produced on disease in the county of Worcester by the enclosure and, consequently, the drainage of land. Sir Charles Hastings showed from the records of the Worcester Infirmary that down to the beginning of the present century ague was the predominant disease, and that the books of the Infirmary were full of records of such cases; but from the time when the great enclosures in Worcestershire took place, such as the enclosure, for instance, of a great part of Malvern Chase, when the land, though it

was not deep drained, was thrown into furrows for cultivation and ditches were dug, and the surface water carried away, the records of the Infirmary ceased to show cases of ague. Now, if Mr. Marten would allow him, he would give one example from his own experience of the prevalence of "Cloaca Maxima" in houses no very long time ago. Some few years since, he resolved, as Chairman of the House Committee of the Quarter Sessions, to have a thorough investigation of the Shire-hall, which was within the bounds, though not within the jurisdiction, of the city of Worcester. He found that the sanitary condition of the building, as he had strongly suspected, was this: the only drain out of the house was a very large brick drain under the hall, which discharged into a cesspool under the drive just in front of the house, which cesspool had never been approached after its formation for a period of forty years. There was no other outlet of any kind, and there was not a single convenience in the place which had any pipe into the open air. He had the drain, the bricks of which were saturated with sewage matter, filled up and thoroughly deodorised, and a drain of humble little glazed pipes, such as Mr. Marten had spoken of, was constructed on each side of the house outside, with ventilating shafts, carried to the top of the roof in every instance. Since that time the Shire-hall had been a thoroughly sanitary building. He was glad to hear Mr. Marten's remarks about the importance of plumbers' work in sanitary matters. He was also glad to hear that there were no small number of plumbers who had obtained certificates from the Sanitary Institute attending the meeting in Worcester, thus showing that they were not only willing to go to the Institute to perfect their knowledge and to obtain certificates, but that they felt an abiding interest in its work. There was one expression in Mr. Marten's address from which he must take leave to differ on a matter of fact. Mr. Marten spoke of the large sanitary powers that had been given to County Councils. He (the speaker) would be very glad to be told what they were, for as Chairman of the County Council of Worcestershire, he was naturally most desirous that it should in every respect fulfil its duties; but beyond some small matters, he was not aware of any function which it was possible for the County Council to fulfil under the present Act so far as sanitary matters were concerned, with the exception of course of their River Pollution powers. The County Council could, and he hoped would, appoint a Medical Officer of Health: but unless the other sanitary authorities of the county joined in giving him powers, the officer's functions would be necessarily confined to obtaining information and reporting, and he would be unable to do any really active sanitary work of any description. The County Council had powers of enquiry and slight powers of supervision, but they had no power to do sanitary work themselves; and he could only hope that Mr. Marten spoke in the character of a prophet as to the legislation that would come in future years, as the experience of Parliament grew, and as they discovered (as he hoped they would discover) that wide powers were necessary for efficient administration in these matters, that it was not the small bodies to whom they could as a rule profit-

ably entrust the health of the population of this country. With regard to the County Council of Worcestershire, if Parliament would only entrust them with some of those large sanitary powers of which Mr. Marten had spoken, he would undertake to say that they would be at once promptly used by the Council. Some people seemed to regard the Institute and its meetings as a means which individuals used solely for the purpose of ventilating their fads. How far this might be so he was not in a position to discuss. He could only say that all he had heard at the Congress seemed to be of a most practical kind. If indeed it was thought a fad to desire that their fellow creatures should enjoy good health, that they should be free from disease, that they should attain to a good longevity, then he admitted that the Institute was certainly productive of fads. From what he had seen and heard, he believed the Institute was carrying out a noble object in spreading among people of this country in every place that it visited sound practical knowledge on sanitary matters, and in instilling into them a high ambition to emulate all that had been well done in sanitary science, and to apply it to their own administration and to their own homes.

On "Sewage Disposal," by Prof. Henry Robinson, M.Inst.C.E., F.G.S., F.S.I.

The subject of "Sewage Disposal," which I have been desired by the Council to bring before this Congress, may with advantage be regarded from two points of view, namely, one which immediately concerns the individual householder and his family, and, secondly, that which affects the community.

As one of the objects of these Congresses is to impress upon the public mind the necessity for attending to well known sanitary rules as regards house sanitation, I would at the outset say a few words in this direction, knowing as I do how requisite it is to repeat the simplest truths to ensure their being acted upon.

I have no hesitation in stating my opinion that only a very small proportion of the dwellings of the upper and middle classes throughout the country are free from dangers to health, owing to the indifference or neglect of the occupiers to ascertain whether the essentials to making a house healthy have been complied with. This opinion I hold both with reference to houses in the Metropolis and other large towns, and also with reference to mansions and detached residences in the country.

Places of health resort are visited by those who seek a brief rest to recruit their worn out energies, and who occupy houses about whose previous sanitary history no informa-

tion is available and none is sought by the temporary occupants? It is within the experience probably of every one of my audience that defective sanitation has been discovered in either the temporary or permanent homes of themselves or of their friends, and that the resultant evils were traceable to causes that could have been easily ascertained and remedied had there been a proper previous examination of the house. To most people who are not experts the word "drains" is one which inspires a feeling of annoyance and disgust, simply because it is associated with an unknown and uncertain amount of trouble and expense. It requires an attack or threatened outbreak of illness to bring home to some people the wisdom of putting their house in order in regard to matters affecting health. Anyone can ascertain whether his house is liable to be invaded by sewer gas through untrapped sinks, bath wastes, closets, or other places (which too often are badly arranged), by pouring some pungent smelling liquid (like peppermint) down a gulley outside the house, having previously closed all windows. The presence of this pungent smell at the points I have indicated will be a sure sign of the existence of grave defects, which will pollute the air and water as well as the food, especially milk, and produce either illness or enfeeblement of body and mind.

These few preliminary observations are thrown out with a view to warn any who may be living in a fool's paradise of ignorance or indifference as to the sanitary condition of their dwellings, not to continue to adopt the "out of sight, out of mind" policy on so grave a matter, but to make a point of ascertaining that they are free from the dangers to health through defective house sanitation, which in my experience so widely prevail.

I have thought that the limited time that this paper can fairly occupy would be best devoted to the consideration of some of the most important matters which are attracting the attention both of the public and of experts. I think there will be few, if any, who will regard the means adopted, or in course of adoption, with regard to the disposal of the sewage of the Metropolis as final, or even temporarily satisfactory. It is matter of history that the scheme of discharging the sewage of London at the Barking and Crossness Outfalls, which the Metropolitan Board of Works carried out, was not in accordance with the advice of a Committee of Referees appointed by the Government in 1858 (of which the Chairman of the Sanitary Institute, Sir Douglas Galton, is the surviving member), who considered that sufficient provision was not made for the prevention of the flooding of low-lying portions of the area to be dealt with, and that an

unnecessary volume of sewage had to be pumped. They further advised that these Outfalls were in such close proximity to the Metropolitan boundary that the sewage would be liable to return with flood tides, and that deposits of mud, dangerous to health, would take place in those parts of the river where shoals and slack water occurred. The Referees advised carrying the Outfalls to Sea Reach, and largely increasing the gravitation area. These recommendations were disregarded, but experience has shown that the Board of Works might with advantage have listened to them. All who have watched the results will concur with me when I say that the evils that were anticipated have been in the main realised, although it required a Royal Commission and a large outlay of ratepayers' money to establish the necessity for remedial works to prevent the continued pollution and injury to the Thames. The Chemical Precipitation Works which have been added at the Outfalls have for their object the deposition of the solid matter in the sewage, and the removal of it to sea in steamers. The results that have as yet been obtained are far from satisfactory, and in the various experiments that have been made as to the chemicals to be used and their proportions, very grave doubts exist whether anything approaching the requisite standard of purity of effluent has been attained, and my own experience of the river near the outfalls convinces me that serious pollution continues. The late Board appears to have carried to the end of its existence a disregard of the advice given by those it called in to its assistance, inasmuch as Sir Henry Roscoe, who was consulted in 1887, and who carried out observations and experiments with a view to produce a better state of things, seems to have found the task a hopeless one, for he published a report in May last which condemns both the remedial works, which have been executed at enormous cost, and also the system of chemical treatment and of sludge disposal. I have referred to this important subject because the newly created County Council should regard in a critical, and even a suspicious, spirit the traditions of the late Board, and should give careful and independent consideration to the whole question of the outfalls, so that no long period will be allowed to elapse before the Thames is relieved from its present pollution, and the Metropolis ceases to defile the river with impunity. The Council is fortunate in having appointed as Chief Engineer, Mr. Joseph Gordon, whose well-known experience and ability justify a confident hope that he will grasp this important question, and will effect a solution of a problem which admits of settlement if approached free from partisanship or prejudice.

The disposal of the sewage of the various towns situated in

the Thames Valley is making good progress, and every year shows a steady diversion of untreated sewage from the river, which for so long has been regarded by local authorities as the natural carrier of their filth, causing annoyance and injury to adjoining people. This custom has been very well compared to a man throwing a dead cat out of his own garden over the wall into his neighbour's.

In speaking of sewage disposal in the Thames Valley I would give prominence to the recent completion of the sewerage works of Kingston, for two reasons. Firstly, it was mainly owing to the resolute action of the Corporation of this town that the Lower Thames Valley Main Sewerage Board was dissolved, and the various towns composing it were left to group themselves according to their natural circumstances and interests, as I had throughout advised. Secondly, because at Kingston the A. B. C. Company have undertaken the disposal of the sewage under conditions which justify special reference in this paper. It is well known that this Company has fought an exceedingly difficult fight for many years in its endeavour to be adopted as the chemical precipitation system *par excellence*. My own view has always been that the A. B. C. system, as worked at Aylesbury with success, produced the best effluent of any chemical system which did not employ filtration in aid of chemicals; but that the cost of the system could only be justified on the assumption that the dried sludge obtained from the process would realize the price of £3 10s. per ton, which it was alleged to be worth. Chemists applied certain conventional rules as to the value of manurial units to this native guano—as it is termed,—and gave a decided opinion that, according to all chemical tests, the material was worth nothing of the kind. The Company, however, have throughout defied chemists and their experience, and have relied on agriculturists' results, which, they contended, proved their case, At last it appears that the chemical system of analysis is no longer to be solely relied on, and two chemists of eminence, namely, Drs. Dewar and Tidy, in a special and elaborate report made for this Company, state as follows:—

"As to the manurial value of the native guano, we are strongly of opinion that this must be judged rather by the practical results of the agriculturists than by presumed theoretical values based on analytical data, and on the price of ingredients not necessarily in the same physical or chemical condition. Recent research tends to show that very small changes brought about in soils may have very important indirect effects."

This statement entirely varies the conditions which have hitherto been regarded as governing the question of the value

of agricultural manures, and the A. B. C. Company now are relieved from the difficulty which has previously pressed heavily upon them, namely, that of employing a chemical process which admittedly entailed a larger expense than other systems without any recognition that a higher value could be claimed for their sludge.

Mr. William Webster has devised a system of purification for sewage by means of Electrolysis, which I have seen in successful operation at the Crossness outfall. The principle consists in breaking up the organic compounds of sewage into their constituent parts, by passing an electric current through iron electrodes, which results in the formation of iron oxides and chlorine. The first produces oxygen and the second produces chloric acid, which destroys organic matter. A non-oxydisable carbon plate is employed for the positive pole, and iron is used at the negative pole, so that by means of a porous diaphragm between, the component parts of the mineral salts are collected. At the non-oxydisable plate a solution of chlorine and oxide of chlorine is produced, and at the negative plate ammonia, soda, and potass are formed, which precipitate the magnesium salts and lime in the liquid. A large portion of the solid and dissolved impurities in sewage are thus deposited in the form of sludge. The process, which is one of much scientific and practical interest, is now under investigation by the officials of the County Council.

Mr. Webster has also arranged an electrical filter for the purpose of treating the effluent where a higher degree of purity is required. He applies the electric current to a carbon filter, the carbon being the positive pole; the nascent oxygen produced in the pores of the carbon by the current destroys organic matter in the fluid, and at the same time preserves the filter in a clean state. This system is obviously applicable to the filtration of domestic water.

M. Hermite (of electric bleaching notoriety) is employing, at Rouen, a battery of electrolysers (with anodes of platinum and kathodes of zinc) to produce a deodorising and disinfecting action upon sewage. He passes the sewage through a battery of this kind containing common sea salt, in the proportion of from 70 to 350 grains per gallon.

I have had under investigation for some time the precipitating and filtering materials which are employed at Acton and Hendon by the International Sewage and Water Purification Company. The process consists in first precipitating the bulk of the suspended and some of the dissolved matters by means of what is termed "Ferozone" (it was formerly called Magnetic Ferrous Carbon), and then in passing the effluent through a filter

containing a material named Polarite. The essential difference between these two materials is that the precipitating substance (Ferozone) which is mixed with the sewage contains mainly sulphate and magnetic oxide of iron rendered soluble, whereas the filtering substance (Polarite) is composed of more than 50 per cent. of magnetic oxide of iron, with silica, lime, alumina, magnesia, and carbonaceous matters which are absolutely *insoluble.* These materials are manufactured from natural deposits which are found in the anthracite coal formation. The main features in this process are as follows: So far as the first part is concerned, the precipitating action is produced without the aid of lime. At Acton about 8 grains per gallon of sewage are employed, and from one to three hours rest are allowed. Clarification and deodorization are thus effected, and the deposited sludge (when pressed into cakes in the usual way) is found to have a manurial value which leads to its being purchased and used on land. The next part of the process consists in passing the effluent from the precipitation tanks through a layer of the other substance—Polarite—and it is necessary to place above it a stratum of sand or other material (the surface of which requires occasional raking over) to intercept any suspended matter which would clog the pores of the filter and interfere with its action. The effect of Polarite is singular, and appears to be unchangeable, at least no alteration in its efficiency has been found after fourteen months use at Acton, according to a report by Sir Henry Roscoe; a longer experience elsewhere is stated to give the same results. This filtering material thus discharges an important function in sewage treatment, as it serves in lieu of a much larger area of land, or of an artificial filter such as is often made by alternate strata of burnt clay and alluvial soil. The explanation of the action of Polarite is that it liberates from its microscopic pores large volumes of oxygen which attacks and destroys organic impurities. The magnetic spongy iron which came into use some years ago for purifying water was found to rust and cake; Polarite, however, is remarkable for its entire freedom from rusting or caking. The results which I have witnessed lead me to form a favourable opinion of it both for precipitating sewage and for the further purpose of filtering effluent sewage either from tanks or from sewage farms when the purification has not reached the required standard.

Another precipitation system, called the "Amines" process, has recently attracted attention. The materials employed are certain organic bases, which are found in the chemical group of Amines (ammonia compounds) in combination with lime. The effect which is claimed for this is that the sewage effluent from

the process is sterile as regards the presence of living organisms, as the re-agent which is formed by the chemicals is completely destructive to organic life. I have witnessed a trial of the process at the Wimbledon Sewage Works, where herring brine is used, which is mixed with milk of lime and evolves a soluble gaseous re-agent having a briny odour. This, when applied to the sewage, produces rapid deodorization and deposition of flocculent matter. Dr. E. Klein, F.R.S., has examined the process and confirms the sterilizing of the effluent which is claimed.

The observations and experiments of Mr. Robert Warrington at Rothamsted, on the distribution of the nitrifying organism in the soil (which are at intervals brought before the Chemical Society), have greatly assisted those who are interested in the purification of sewage on land. Dr. Munro at Salisbury has made (and is understood still to be making) very useful trials with reference to sewage sludge. All experience now tends to the conclusion that the old bugbear of chemical precipitation, namely, sludge, no longer need exist where proper precipitants are used.

The regulations which are enforced in this country to diminish death-rate by proper sewerage and sewage disposal works, should be applied abroad wherever our influence can be exerted to mitigate sanitary evils which abound in many great centres of population in the British Empire. At the recent International Congress of Hygiene in Paris, the insanitary condition of Alexandria was referred to, and its state was denounced as a danger to all Europe. The necessity for properly dealing with the sewage of Calcutta has long been recognised, and it is understood that steps are being taken to remedy the existing unsatisfactory state of things that prevail there, Mr. James Kimber, C.E., being now engaged in advising the Commissioners of that place what ought to be done. Numerous similar large centres of population under our influence could be quoted where much needed sanitary reforms are demanded.

There is a great waste of public money throughout the country in regard to sewage disposal. Many towns are continuing the employment of systems which have long since been superseded, and I consider that a time has arrived when an investigation by an impartial and qualified Commission into the question of sewage disposal would lead to most valuable and useful results to the community, both from a sanitary and economic point of view.

Mr. W. C. Sillar (London) thanked Mr. Robinson for his paper on sewage disposal. With regard to that part of it in which he alluded to the process now in operation at Kingston, he would

remark that this was no longer merely experimental. It had long passed through the theoretic stage, and its success was now an acknowledged fact. The great requirements in sewage treatment are four in number; we have not only to be satisfied with the purity of the effluent water, and with the preservation of the manurial value of the deposit, but it must be done in such a way that the water is admissible into rivers without injury to the fish, and without causing any nuisance to the neighbourhood. He contended that no solution of the sewage problem should be considered complete which did not preserve the manurial products for the benefit of the agriculture of the country. It was national waste and wrong doing to continue to pollute our streams with what had been proved to contain such great manurial excellence.

Mr. F. Corbett (Worcester) said Dr. Strange had suggested to him that, as Chairman of the Sewerage Committee of the Worcester Town Council, he ought to take some little part in the discussion of the morning. He did so with some diffidence, because they in the local sanitary bodies had not to discuss the various processes which were recommended by inventors. They had to deal with experience which had been gained over a protracted period by other authorities, and to act under the advice of gentlemen of great experience such as their engineer, Mr. Hawksley. In listening to the papers this morning he was not surprised to find that Mr. Marten sat somewhat heavily upon a dictum which was somewhat hastily and crudely announced the other day by the President of the Institute when he laid it down that broad irrigation was the solution of sewage difficulties. Mr. Hastings referred to the case of Malvern. That was an exceptional case. Malvern was a small town, scarcely more than a village, situated on the slope of a considerable hill, and there was a large area of land sparsely populated immediately below, and under the control of people who were deeply interested in the prosperity of Malvern itself. Under those circumstances there had been no difficulty in disposing of the sewage by gravitation, but even at Malvern great difficulties had been found in the way of applying a system of broad irrigation. He (Mr. Corbett) was professionally concerned in a case in which the Malvern local authority had to pay a considerable sum as damages for the gross pollution of the stream into which the effluent water from their sewage works poured. He remembered a case of serious outbreak of disease in the low parts of the town of Malvern caused by the miasmatic vapours which arose from the sewage farm. Within the last two months he had inspected the stream into which the effluent flowed. It was neither adapted for the use of the people nor for their recreation. They would not dream of taking drinking water from it. They would find it far worse than the much abused Severn. They would not dream of recommending a maiden to dip her tresses in it. She would not take their advice if they did so. He was not surprised that the readers of papers that morning were of opinion that the true solution of the drainage difficulty was precipitation, followed perhaps by some system

of filtration of the effluent water. The idea that they were going to use either the crude sewage or the effluent water in a profitable manner in farming operations was an entire delusion, which had been exploded over and over again, and ought not to be repeated. It had been said that the only difficulty now left in dealing with sewage by precipitation was the question of cash. There was another difficulty—the question of local sentiment. They had prepared a scheme in Worcester of dealing with sewage by precipitation, but they were met at once by objections to any possible site. They were told on the one hand that they must have a site within their own boundary because no neighbouring authority would tolerate the nuisance of their works. They were told on the other hand that within their own boundary it was unfitting to place such works. One gentleman had objected to the site because his house was within two miles of it. He believed the discussion which had taken place this morning would somewhat appease the public sentiment of Worcester, and relieve the minds of those people who thought they were going to be seriously injured by having sewage precipitation works a quarter or half a mile off their dwellings. The members of the Sewerage Committee of the Worcester Town Council had inspected several precipitation works, and when properly conducted they found no evil resulting from them, and no nuisance to the neighbourhood. Notably was this the case at Sheffield, which had works on a modern principle. It was very difficult to get people to believe that they would not be seriously injured by having sewage works in their immediate locality. If they could get rid of the difficulty by any discussion which might take place at the Congress they would render a considerable service to the citizens of Worcester.

Professor H. Robinson, M.Inst.C.E. (London), said that as regarded the question of irrigation that had been referred to, he did not go so far as some of the speakers, and say that the disposal of sewage upon land was to be looked upon as a thing of the past. The question of sewage disposal required to be dealt with skilfully according to the conditions and necessities of each town. A great danger had arisen of late years owing to Committees composed of amateurs being deputed by the sanitary authority to which they belonged to visit various sewage works with the view of getting information as to what was the best thing to be done. There was great danger that, acting under such conditions, men would sometimes form opinions based upon very limited knowledge. So many engineering and chemical questions were involved in the general question of sewage disposal that he would warn those who were endeavouring to get information not to act on the opinions they might form without the fullest consultation with experts, independent of any interest in the various systems. As to the proposal that they should convey sewage uphill by pumping instead of letting it go downhill by gravitation, that was very well for those who would obtain the necessary land for irrigation at any cost. He was a thorough advocate for dealing with sewage on land suitably situated and not imper-

vious in its nature, but those conditions did not always obtain ; and an engineer was bound to deal with each town according to the requirements of the case. He endorsed all that had been said as to the importance of having small sewers and good gradients. Sewers, if properly designed and carried out, could be made self-cleansing, free from nuisance and from the production of sewage gas.

On "The 'Amines Process' of Sewage Treatment," by R. Godfrey, F.S.I., Assoc.M.Inst.C.E.

From the City of London, with its population of teeming millions, through all the gradations of cities, towns, local board areas, down to the humblest hamlet, the question of the disposal of sewage is the one great problem which is agitating the mind of those whose pleasure and duty it is to take cognisance of the public weal, and although the subject has formed, and will continue to form the staple of discussion wherever sanitarians congregate, we seem to be only on the threshold of the solution of the problem. And it is with the object of adding one more item to the lengthy catalogue of papers on the subject that I venture to lay before the Congress the results of enquiries undertaken in the interests of the district with which I am officially concerned.

The history of the sewage question is familiar to all present, and the necessity of a satisfactory solution is sufficiently patent to every one to justify me in omitting all generalisations.

Having to contend with the sewage of a couple of villages, in one of which there is a large paper mill, making about sixty tons of paper per week from the coarsest material, I have been for some time looking for a satisfactory solution of the problem: how to avoid an action for polluting a stream, and, at the same time, to assist the manufacturer, and by so doing benefit the district in which I am engaged. The difficulty is to decide which is the best process, as I find that the first patent taken out for treating sewage was by Higgs, in 1846, just over 43 years ago, and from that time to the present the rate at which patents have been taken out has been about one per month, and yet *the* secret has not yet been discovered, nor has the fortune of the inventor yet been safely invested in "Goschen's."

Almost every chemical of the laboratory has been tried for precipitating the solid matters, and almost every substance known has been tried as a filtrant. One quasi scientist actually using chloroform in his process.

The substances which have maintained their position are

lime and sulphate of alumina—scarcely one inventor who does not use one or other of these substances, milk of lime taking the lead. To this is added, by various experts, various chemicals, which are supposed to have the power of neutralising the deleterious matters held in solution. Still, Lord Bramwell's Royal Commission, 1884, on Metropolitan Sewage Discharge, sums up the whole case with the pregnant words, "*no known process of precipitation purifies sufficiently*," and sanitarians are still in the dark as to the great problem of the day. The number of new schemes for purifying sewage still increases, and it is to be hoped that scientists will evolve a method which shall remove the reproach contained in the report alluded to, and which ought not to be allowed to become a *standing* reproach.

Every scheme has now to run the gauntlet of acute critics, who have been educated to criticise during the last forty years, and the authority which has the temerity to adopt a new process, does so at considerable risk of honour and reputation.

The rate at which new schemes are brought out seems to increase, but few are other than devices for ringing the changes on the old formulæ.

In my enquiries I came across the Sewage Works at Wimbledon, where a good system of purification by the lime process was in action under a careful and observant engineer.

The machinery and plant is of a very good type, and a farm is well laid out for irrigation by the effluent.

At the time of my first visit, I found that the works were, by permission of the Local Board, for a time in the hands of a Syndicate, which professes to have found out the grand secret. The normal treatment, as adopted by the Wimbledon Local Board, was suspended, and the "Amines" Syndicate were carrying out a practical demonstration of their system. A new re-agent has been discovered, which so far seems to have more than answered the expectations formed of it.

The requirements of a satisfactory process of dealing with sewage are—

1. A harmless effluent.

2. A harmless liquor from the sludge presses where pressing is adopted.

3. A minimum amount of sludge.

An effluent to be harmless must not only be sufficiently pure that it may be applied to land for irrigation without causing offence, but it ought to be so pure that it may be at once turned into a river, containing at least ten volumes of water to one of effluent without the need of irrigation, and to render it so pure it must be deprived of all living organised matter, as well as the matters held in solution. This, to the eye of the ordinary

observer, may appear easy, but to the searching powers of the microscope, in the hands of a careful observer, our purest waters display some of the lowest forms of organic life; how much more, therefore, may it be found that effluents from sewage works, alleged to be harmless, are teeming with life in its most dreaded form, viz., the various bacteria, the typhoid and pneumonia bacillus, and others. Until we arrive at this degree of purity we must not cease in our endeavours to solve the problem.

The sludge question is the most serious of any in the management of a sewage farm, and any process which materially increases its weight must be shunned, unless it has some overwhelming advantages per contra. Sanitarians must not dwell too largely on the profit side of sludge manipulation. Sludge is matter in the wrong place, and must be got rid of at any cost. If it can be utilised, so much the better; but when we find cities making 500 cube yards a day, it is enough to appal the senses. How and where is all this sludge to be disposed of? Land on which to utilize it is not always available, and in my opinion cremation will have to be resorted to, unless its quantity can be materially reduced.

In dealing with the sludge by pressing in one of the various types of press now before the engineer, a difficulty is sometimes felt in disposing of what is technically termed "Press Liquor." To satisfy the requirements of the case this must be of equal purity with effluent, and unless it is so our assent to any scheme as perfect must be withheld.

With my mind in a thoroughly sceptical condition, my visit to Wimbledon, on August 17th last, enabled me to examine minutely, how far the three requirements before named were met. And I am bound to say that, as far as the first requirement is concerned, I was most agreeably surprised. I saw at one stage of my examination of the works, the ordinary effluent flowing on to the land. It presented the usual cloudy appearance as it boiled out of the chamber; the bottom of the chamber was not visible, and it differed in no respect from the many effluents which are distributed over grass land, and was totally unfit to be sent direct into a river.

A large subsiding tank of about 90,000 gallons was being filled with the sewage from Wimbledon, and as it passed into the carriers a supply of milk of lime was being mixed with it; and, here comes the difference—a small quantity of herring brine. All the additional plant required was a small tub against the lime-mixer, from which the lime flowed in a fixed proportion. A complete mixing took place at the tank inlet by aid of a dash-wheel driven by the inflowing current. As the tank filled, the disturbance of the volume of sewage was gradually confined to

the centre, where the course of the incoming stream could be distinctly traced, while near the sides the process of precipitation could be seen in operation even before the tank was full.

The solids in the sewage were gradually aggregated into flocculent particles, and on the supply of sewage being cut off the whole tank's contents assuming a state of quiescence, the work of precipitation proceeded with a rapidity which was noteworthy.

The tank was six feet deep, and provided with a floating mouthpiece to draw off the super natant liquid, and this was sent, after half an hour's precipitation, at once to the irrigation area through the same chamber as that from which I had seen the normal effluent some little time previously. The contrast was striking. The effluent was clear enough to allow the bottom of the chamber to be seen, and all trace of smell was gone. The briny smell caused by the introduction of the re-agent was particularly noticeable. I took a sample, which is now before you.

The press liquor obtained from the same sludge is equally brilliant and briny. There was a complete absence of that sickly fœtid smell which too frequently pervades sewage works, under the most careful management.

In the Report of Lord Bramwell's Commission on Metropolitan Sewage Discharge (1884), the description of the rationale of precipitating processes is remarkably lucid, and I may be pardoned for transcribing par. 229 of that Report.

"Precipitating processes, though the same in principle as those of thirty years ago, have been greatly improved in detail, and when well worked are effectual where the quantity of sewage is not great, where the sewage can be properly treated, and where there is a running stream into which the effluent can be discharged in a proportion not exceeding five per cent. of the supply of fresh water.

"There are two chief methods by which effete organic materials, such as excreta, are got rid of, namely, by fermentation and by oxidation. Nature, in this climate at all events, utilises both these processes, and in the above order. The organic molecules of effete matters are first split up by fermentation (and putrefaction is one kind of fermentation) into less complex substances, often of an offensive character, and these are subsequently oxidised into inodorous inorganic substances. The agents by which these fermentations are brought about are those microscopic organisms known as bacteria, which either themselves set up fermentation, or excrete substances which act as ferments.

"Bacteria or their spores are present every where, and, gaining

access to sewage, set up fermentation. But they require time for their propagation, and the setting up their resultant fermentation.

"Now, the whole art of treating sewage chemically, as it is termed, is to precipitate and clarify it while fresh, *i.e.*, before bacterial invasion has so far advanced as to set up active fermentation. When this is once set up the results are very disappointing. Precipitation consists in producing an artificial precipitate or coagulum in the fluid, and this coagulum mechanically entangles and carries down the organisms into the sludge. The effluent, now freed in great part from these, must then be brought as speedily as possible under an oxidising influence, either by turning it into a stream containing sufficient oxygen to oxidise the organic materials, or by applying it to land where it is also brought under powerful oxidising influences.

"Should, however, the effluent be kept undiluted, or should it be turned into a stream in too large quantities for the free oxygen to deal with, the organisms or their spores which have escaped in the effluent multiply and set up a renewed putrefaction. Such effluents, though apparently clear, become clouded, and a second deposit takes place in them. Bacterial fermentation of the cleanest fluids is always attended by clouding and turbidity."

This quotation points out very clearly what is required, and it is claimed by the inventor of the Amines process—and I am bound to confess with very great reason—that he does effectually destroy the bacteria, and so remove the possibility of any fermentation arising.

The new re-agent is produced by the action of lime on certain organic bases belonging to the group of "Amines," or ammonia compounds. When these organic bases are acted upon by lime a very soluble gas is evolved, which spreads rapidly through every part of the liquid and is held in solution therein with great tenacity. This gaseous re-agent has been found to be antagonistic to the existence and propagation of every species of bacteria occurring in sewage and other similar waters, for it utterly extirpates them in a remarkably short space of time.

The effluent from such water after treatment by this process is actually sterilised; it shows no living micro-organisms whatever, even under the most powerful microscope, and its sterility is further confirmed by the latest and most severe test known to modern science, viz., inoculation on nutrient gelatine and plate cultivation.

In support of this statement, which cannot but arouse the greatest interest in the sanitary world, I cannot do better than quote from a Report by Dr. Klein (who has just been honoured by the British Medical Association with the Stewart Award).

He examined some sewage—press liquor sludge and subsidence effluent, taken from the sewage works at Canning Town, where an application had been made in January this year. In the sewage he found 2,400,000 organisms; in the press liquor he found 650; in the sludge 400; and in the effluent none. The quantity examined being in each case 1 cubic centimetre.

"This number of bacteria found in the press liquor and sludge is far below that found in ordinary drinking water, such as the water supplied by the various London Water Companies, after this has been stored for a few days, and in some cases even the day after collection."

Dr. Frankland (Proc. R. S., No. 245, Vol. 40, p. 51,) has found that the filtered river water supplied by the London Water Companies contained per cubic centimetre on an average (on January 26th, 1886) 1,525 organisms.

In July of this year Dr. Klein again reported, but this time on a sample from Wimbledon, when the sewage was being similarly treated. In the crude sewage he found 768,000 microbes per cubic centimetre; in the mixture effluent and sludge well shaken up 100 microbes; and in the effluent which was subjected to the gelatine plate test for three periods, viz., 24 hours, 72 hours, and 144 hours, there was a total absence of microbes. And he further says, "the effluent must be pronounced sterile;" thus pointing to the fact that a process had been discovered which satisfies two of the requirements set out at the beginning of the paper, viz., a harmless effluent and a harmless press liquor, both devoid of microbes, and both fit to turn into a river, as on its discharge into a river it could cause no increase in the microbes already present in such river.

As a natural consequence of the sterilising action of this re-agent, decomposition of organic matter, whether incipient or far progressed, and the objectionable phenomena of putrefaction attendant on such decomposition are completely arrested, and even new infection cannot beget fresh putrefaction as long as there is a sufficiency of the gas remaining in solution. In elaborate and repeated tests made by the Government Analysts at Somerset House, upon samples of effluents from various experiments carried out with this process on Metropolitan outfall sewage (the quantities treated aggregating half-a-million gallons), the sterility of the effluent, and also its immunity from new infection, has been conclusively proved, the samples having been kept for four weeks in contact with air, at a temperature of between 70° and 80° F., with occasional exposure to the direct action of the sun's rays.

"The Amines," from which the process is named, exist in many substances in nature. And herring brine is one only of

the many sources from which they can be obtained. They are used either pure or in the form of Amine salts, or in one of the numerous substances containing them. But at present the brine is the cheapest and most readily procurable form in which it can be obtained. And the re-agent formed by its admixture with "milk of lime," and which the inventor has named "Aminol," is a powerful disinfectant, and imparts a sea-breezy odour to the works in contrast to the usual fœtid effluvia.

The proportions of the chemicals, added to the sewage, will vary with the character of the sewage, and with the attending conditions. The cost is stated by the Syndicate, in round numbers, to be from ½d. to ¾d. per 1,000 gallons treated.

Having satisfied two of the requirements set forth, there remains the question of the sludge and its disposal. This is devoid of offensive smell, and permeated with Aminol to such a degree that the inventors claim that, by fortifying the sludge left after a precipitation with one-fifth of the original quantity of the re-agent, this sludge, plus the re-agent, can be economically applied to a second tank full of sewage, and will produce as good effects on the second tank as on the first; and again, by the addition of another fifth of the re-agent to the second sludge so obtained, a third tank can be dealt with, with as good results. This feature in the process is important, and must naturally influence the ultimate cost very materially.

The sludge from this process is of a brownish yellow colour, and lacks the shiny appearance of ordinary sludge; and from its being permeated with the re-agent (Aminol), it may be left exposed to the sun and wind without any fear of offensive vapours being given of. A quantity of about ten tons lying in the open ground at the time of my visit was perfectly inodorous. Treated in the ordinary way by presses, it becomes a *moveable* commodity, half of its moisture having been removed; and it is fully believed that it will be a *marketable* commodity in those places where cost of carriage is not too heavy. Its bulk can be still further reduced, especially in places where a destructor is in use for the purpose of destroying dry rubbish by heat; and laid upon a floor exposed to some of the waste heat of a destructor, it may be made into a powdrette bagged and transported in a handy form. Its manurial qualities are still a matter of investigation, and the Syndicate are acting wisely in not tempting local authorities with visions of large profits from the sale of the cake. The purity of our rivers, and the purity of the air, are matters of far greater importance than a visionary profit from the sale of cake.

On the effect of the effluent on fish life, the inventors claim that, where it goes into a river, and is diluted by not less than

ten times its quantity, it is perfectly harmless, and, being rendered sterile, there will be little fear of the presence of the sewage fungus—*Beggiatoa Alba.*

On the occasion of a second visit to the Wimbledon Works on the 26th August, I found the normal process in operation, the Syndicate having ceased its experiments *pro tem.* There was the usual sickly smell of fœtid matter arising from a tank recently emptied, in spite of a quantity of carbolic acid having been put in to deodorise it, black, repulsive, and mal-odorous in the extreme, a cloudy effluent leaving the tanks totally unfit for the river. The sludge pressing house gives forth a sickly smell, and were it not that the effluent was most thoroughly distributed over the irrigation area, a very offensive state of things would have existed. At the same time, it is but due to the engineer of the Wimbledon Local Board to say that the effluent, as it flows into the Wandle, after a second and often third run on the land, is one of the finest, if not the finest, effluent which is to be seen at any works.

Near to the tanks a broad open trench about 12 in. deep had been made by the Amines people, and into this to the depth of 7 in. or 8 in. a quantity of Amines sludge had been thrown seventy-two hours previously. This sludge, I was told (not by an Amines employé) had been fifteen days in the tank, and may be said to have been the deposit from 1,500,000 gallons of sewage from a purely closet town. Pegs had been placed along the centre of the trench to show the extent to which the sludge would dry up, and although there had been a thunderstorm twenty-four hours after the sludge was put in the trench, bringing with it ·21 of rain, and although there had been an absence of sun, the sludge had sunk to a depth of 3 in.; large open fissures broke up the surface, and there was a general natural shrinking of bulk. After seventy-two hours the sludge was the consistence of plasterer's putty, of a greyish colour, and on taking up a piece on a stick, it proved totally devoid of smell, this proving most conclusively that this new re-agent is a thorough deodorant.

Another advantage may be claimed for this sludge—that it may be spread on land in a liquid state, left to dry by the operation of the sun and wind, and then ploughed in when its manurial values will make themselves felt, without the costly, tedious, and, in the case of all other sludges, offensive process of pressing. Or, when thoroughly dried, it may be used as a means of reclaiming waste lands when they are within reach.

At the rear of the press-house were two heaps of cake—as it is termed,—one from the Amines process and the other the ordinary cake. To press this latter thoroughly it is frequently

necessary to fortify it with an additional quantity of lime; but the Amines cake, if pressed, does not require such fortification—in fact I believe that when the process has been further developed kiln-drying will accomplish all that will be necessary to reduce it in bulk, sufficiently to make it easily portable and ready to be utilised in various ways.

The difference between the two samples of cake could not but strike the most superficial observer, and it may fairly be conceded that at length we are within measurable distance of the time when it will be possible to treat our sewage and its resultant sludge without fear of injunctions and all their attendant evils, without prejudice to the purity of our rivers, and without polluting the air we breathe.

Mr. C. H. Cooper, Assoc.M.Inst.C.E. (Wimbledon), said the local authority of that district were now treating their sewage by the Amines process; until about a week ago the process was merely being experimented with. He did not consider it fair to the Amines process to say that only a small amount of sludge was produced. If that was so what became of the matters not thrown down? The results obtained by the Amines process showed that it did throw down the greater part of the matters contained in sewage. The effect produced by the process in clarifying sewage was very remarkable. In a tank six feet deep the bottom could be seen in about twenty minutes after the sewage had been admitted. Then, as to the sludge. Ordinary sludge cake, as every one knew, was very liable to give off nasty smells after it had been spread on land, especially if exposed to rain and warm weather. During the last eight weeks some sludge cake produced by the Amines process had lain on a portion of the Wimbledon Farm near some cottages, but although there had been plenty of rain, followed by periods of warm weather, no smell had been given off. He did not think Mr. Godfrey fair in what he said respecting his visits to the Wimbledon works. In the first place, the works never had been in the hands of the Amines syndicate; and secondly, exactly the same treatment was in operation at the time of both of Mr. Godfrey's visits on August 17th and 26th, with the exception that on the 17th the Amines process was being applied to part of the sewage. As to the addition of lime to the sludge as it came from the tanks, it is well known that in almost all processes such lime has to be added to the sludge before it is pressed. The liquor pressed from sludge so treated is a concentrated solution of lime, and forms a re-agent to precipitate the fresh sewage to which it is added at Wimbledon. In the Amines process somewhat less than 50 grains of lime per gallon is applied to the sewage in the following manner: the first time clean tanks are charged 75 grains of lime per gallon is added, the second time 50, and the third time 25; the sludge is then removed from the tanks and the operations repeated with the amounts

of lime stated. The cost of the ordinary process and that of the Amines at Wimbledon may be compared as follows:—

Ordinary Wimbledon Process.	Grains of Lime per Gallon.	Amines Process.	Grains of Lime per Gallon.
Lime	10	Lime	50
6 grains of alum equivalent to	20	4 grains of lime equivalent to	6
1 p. e. lime to sludge before being pressed	10		
Total equivalent in lime......	40	Total equivalent in lime......	56

As the works are surrounded with houses, deodorants are used in the summer which, when used, make the former process slightly dearer than the Amines. One great advantage in the Amines process was that a double effect was got from part of the lime. Thus, instead of adding lime to the sludge after it had been precipitated, so as to remove the glutinous nature of the latter, a large amount of lime was at once added to the fresh sewage, which not only precipitated the sludge, but also removed its glutinous nature. As to the amount of water in the river into which the effluent may flow, it is unfortunately not always possible to find a river having ten times the volume of effluent. At Leicester, for instance, the volume of the effluent exceeded that of the river into which it was turned during part of July and August. At Wimbledon the effluent flows over land before being discharged into the river. With the Amines or any other process he did not think it likely that at Wimbledon the effluent would ever be discharged direct into the river without being first passed over the land.

Mr. J. Willis-Bund (London) said, when he heard, during Mr. Godfrey's paper, of an effluent perfectly harmless to fish life, as the Chairman of a large Fishery Board he was naturally glad that such a discovery had at last been made; but he was like the lady who said she had been played that trick before, and so seemed a little sceptical. There were one or two questions he would like to ask. Was this effluent all that it was said to be? He did not say it was not: he only wanted information. In what rivers containing fish had the process been tried and the effluent found harmless? It was said to be a sterilized effluent; but it did not follow that because an effluent was completely sterilized it was therefore not harmful; let them take one example. He believed they could sterilize water completely by adding bichloride of mercury, but that would make the water most harmful to life. He had this further question: might not the discharge of a sterilized effluent in large quantities into a river also sterilize something in the river which they wanted to preserve? Those were points which seemed to require some practical investigation and a good deal more information than they had at present, before they could accept the Amines process as a complete answer to the problem that had been set them to solve. One other point: in the Rivers Pollution

Prevention Act of 1876, it was provided that a local authority was bound to admit into their sewers any beastliness that a manufacturer chose to put there, consequently, in different towns, they had a wholly different state of things to deal with. He once, in cross-examination, asked an eminent chemist, who was recommending a particular process to be applied to a particular case, whether he ought not, before he recommended that process, to ascertain what were the ingredients he was going to apply it to? "Oh," he said, "sewage is sewage." When he (the speaker) ventured to differ, the chemist said the quantity of sewage was so much larger than anything else, that they could leave everything else out of consideration. He (the speaker) did not think they could. How far would the Amines process be successful where there was a good deal of refuse of various kinds passed into the sewers? Might not the refuse of a large manufacturing town have the effect of neutralising the agents which produced the good results which were obtained at a place like Wimbledon, where there were no manufacturers?

Dr. J. W. Tripe (London) said the few remarks he had to make were the result of observations derived from one visit only to the works, and therefore they could hardly be taken as having that weight which continuous record would have. That day fortnight he was present at a meeting of a large number of representative engineers and others, for the purpose of seeing the results of the process and the mode in which it was carried out. It was then stated that seventy grains of lime per gallon were used in summer, and a smaller quantity in winter; and a friend of his who was present told him that he heard on good authority that as much as ninety grains of lime per gallon had been used in summer, and seventy in winter. That was a very large quantity: much larger than had been mentioned by Mr. Cooper, the assistant surveyor to the local board at Wimbledon. The effluent was turned on to the land before it went into the river, consequently the effects on fish and the effects on microbes would be materially altered. With regard to the growth on the land he saw at Wimbledon, it was what he should call bad; he did not know whether it was the Wimbledon sewage or the Amines process that was responsible for it. In one part there seemed to be more weeds than anything else. The growth was not by any means so satisfactory as he had seen it on other sewage farms. His nose informed him of an extremely offensive smell; and on looking about to ascertain the cause, he found a large quantity of black sewage amongst a bed of willows. He had always noticed that when sewage got too bad to be carried anywhere else on a sewage farm, it was sent to the willow-beds. There had been two processes going on at one time at Wimbledon, and it was difficult to discriminate as to the results of each. Certainly the sludge thrown out on the ground had no bad smell. He would have said that the piece he took up and broke was nearly all lime, and he thought that if a person bought it to apply to land except as lime he would get very little for his bargain. If the process was to do any good it required more herring brine, and less lime.

He (the speaker) had no interest at all in the matter, except this: that he wanted to see something introduced which, so far as they were concerned at Hackney, where he was Medical Officer of Health, would prevent them from being half poisoned by the sewage which came down there. Another point which seemed to him singular was that most of the examinations which had been reported upon had been made when there had been either a low temperature or much rain. During August they had a remarkable quantity of rain, and that was just the time when these experiments were made. These were points for careful consideration. He was also told that as many as six charges were put into the tank before the sludge was taken out. The engineer would tell them whether that was correct or not; if that were so he was surprised that the effluent came out without smell, as they were told it did. The last speaker pointed out one matter of great importance. If they killed all microbes, injurious and others—for as yet they could not distinguish the injurious from the non-injurious—what about the water? They knew that the oxidation of water went on to a great extent through those microbes; therefore if they destroyed them all, they must have a water which would become bad. It certainly did not seem to him that this process approached anything like perfection.

Dr. A. Carpenter (Croydon) observed that, like Mr. Marten, he had been a disciple of Sir Edwin Chadwick, and had learned from him a large number of lessons which he had been carrying out during the last forty years of his life. He had heard during that time from the promulgation of the process of Higgs downwards until to-day, year by year, statements which corresponded almost entirely word for word with those that had been put forward that day with regard to the Amines process. The only varying point they had in addition was a few grains of herring juice, which certainly gave him an amount of new vision and a little novelty which he had not before as to how to deal with sewage. He was not going to dispute the facts put forward by the promoter, but the point raised by Mr. Willis-Bund and Dr. Tripe to his mind destroyed any value that might have been attached to the process as a means of purifying sewage. They did want microbic life and they could not do without it. If they destroyed it they would do an enormous amount of mischief with regard to their water supply and the life that existed in rivers. He thought Mr. Corbett had given expression to views which were totally wrong, because he had only taken a very narrow area from which to give his experience. Taking his (the speaker's) own case: for thirty years he had had under his eyes, and for a large number of those years under his management, a sewage farm extending over from 400 to 600 acres of land which had been carried on on the same site for thirty years in the midst of a dense population, surrounded by houses of a large value, and occupied by persons who would not hesitate to protest if they perceived any nuisance to their property. What had been the result? At this moment the sewage of from 60,000 to 70,000 people was utilised on the farm, and the effluent as it flowed off was

equally as pure as it was twenty years ago, when Dr. Frankland reported on it. With regard to the effect upon the health of the neighbourhood. When the farm was first started, the death-rate in his (the speaker's) district was 26 per 1000, at this moment it was fourteen, and of the last three years it had been under sixteen, while the death-rate of the parishes immediately on the borders of the sewage works was 12 per 1,000. There was no area round London that could vie with the area of Croydon and the area of Beddington and Wallington which lay around the farm, with regard to sanitary arrangements as shown by the birth-rate, death-rate, and the record of zymotic diseases. What had been the effect upon the rates? They had purchased the whole of the land, not at agricultural prices but building prices, paying for it from £200 to £400 per acre, the whole amount was £187,000, capital cost incurred in the purchase and laying out of the land, yet on no occasion had more than a 2d. rate been asked for by the Local Authority for the purpose of dealing with the sewage. His experience led him to the conclusion that it was the best way in which a district could deal with its sewage if they wished to prevent it becoming an expense to the locality. The cost of the purchase of the farm must fall on the locality that wanted it; but the working expenses might be kept down to a very low figure provided that the farm was not managed on agricultural principles. The agricultural mind took it for granted that sewage must be made to stink before it could be of any use; but the great principle with regard to sewage farming was that you must not allow your sewage to stink—no time must be allowed for this object. It must be fresh. It must go directly into the sewer, and the sewer if it was properly laid, would not give it time to ferment. There would be no fermentation, and the microbic life, which existed all over that farm in an enormous proportion would deal with the sewage not by oxidizing it or by a process of fermentation, but by a process of digestion. It would be digested by the microbic life on the farm, which would take out the whole of the ammonia from the sewerage, and the effluent water would go through, only carrying a certain amount of salts, and if the farm was properly managed, that effluent might be received into any stream without the least fear or danger. He had seen over and over again in their carriers trout which would come up from the river Wandle, and which preferred their effluent water to that which they got in the stream itself, the latter was sometimes muddy, the effluent never unless when the carriers were being cleaned out or repaired.

Dr. H. J. Strong (Croydon) said he was able to endorse most thoroughly Dr. Carpenter's statement as to the value the sewage farm had been to Croydon. New sewage ought not to smell at all. The fresh sewage from the furthest part of their boundary, arrived at the outfall about two hours from the time it passed into the sewer. It was there met by an extractor designed by Mr. Baldwin Latham, which consisted of a large revolving sieve-wheel; the sewage flowing against this, the more solid portions of the sewage were retained, whilst to prevent the machine clogging, a fine stream of pure water

was thrown against the wire-work. The solid manure is mixed with earth, and used on the farm, and this solid matter forms but a very minute portion of sewage compared with that which is in a state of sludge, and which, flowing through the carriers, is distributed over the land. Both precipitation and irrigation had their defects; either were proper in different localities, but in his opinion irrigation was the best process, because they got rid of the sewage without smell, and with nothing noxious to the inhabitants in the neighbourhood. A corporate body had no right to look upon sewage farms from a commercial point, with a view to profit. The best thing to make it pay was to secure the absence of zymotic diseases, and at Beddington they had enjoyed perfect immunity at a time when zymotic disease had been prevalent in the places around them. If a Sanitary authority disposed of its sewage, and the effluent water was sufficiently clear and pure to pass into a stream without doing harm to the animal life in that river, it accomplished all it wanted, and a moderate cost was not of such importance as the successful carrying out of the object for which it was instituted.

Colonel Jones (Wrexham) thought that the deputations from corporations which went about from place to place to see what had been done in the matter of sewage disposal, would do far better if they sent for advice to those who were thoroughly competent to give it. He had had sewage of 12,000 people to deal with upon 150 acres of his land for eighteen years, and he had found that the growth of crops was promoted, and the sewage was dealt with efficiently and entirely innocuously. From physical reasons every drop of the water from his sewage farm which was not evaporated must flow into the Dee a few miles from the place where the stream was tapped for the water supply of Chester. Therefore his sewage farm was being constantly watched by the water company and the Medical Officer of Health of that city, and when he stated that he never had any trouble of any kind from their visits he thought they would agree with him that he might be satisfied with the effect of land filtration. He did not agree with the view that sewage should be dealt with by sterilisation and postponement of the stage of putrefaction. Nature taught them that putrefaction or fermentation was the only means by which sewage could be broken up and made innocuous. The great point of Mr. Dibdin and Dr. Dupre, who had treated the subject thoroughly scientifically, was the action of organisms in breaking up the sewage and rendering it innocuous. The great point upon which the Amines process was recommended to the public was its sterilizing disease germs, but they could not distinguish between profitable organisations and the rest. That appeared to him to be a misunderstanding of the scientific mode of dealing with sewage. To him it seemed that this was only a variation of the old lime process. They were asked to make an addition of three grains of fish-brine, which had the attraction, to the public mind, of being a homœopathic dose. Three grains per gallon as compared with seventy grains he called a homœopathic dose.

Mr. Corbett (Worcester) said one or two speakers had referred to the investigation which had been carried on by the Worcester Town Council as if they had acted upon their own responsibility. If they had followed his remarks that morning, they would have noticed that he said they were acting under the advice of an engineer of great experience, and he referred to the name of Mr. Hawksley. He thought a public body, acting under the advice of a gentleman of such vast experience, could hardly be said to be acting on their own responsibility. He, however, thought public bodies would do some good by using their own eyes and using their own noses too. The Committee of the Town Council in inspecting various sewage farms and works were able to test, by practical observation, whether the statements made by experts were altogether reliable. He was not surprised that those who were charged with the management of the Croydon Sewage farm were prepared to stand by their "pet." But there were exceptional circumstances in the case of Croydon. There was a large area devoted to the farm at Croydon, but Croydon was a growing town, and if the farm remained at its present area and Croydon continued to increase, no one would say that in thirty years time the farm would be able to grapple with the sewage of Croydon and discharge a satisfactory effluent·water. A sewage farm on the irrigation principle could only be satisfactory under very exceptional circumstances of soil and situation and so forth—circumstances which did not exist in the case of Worcester, and which existed in very few cases.

Mr. G. W. Hastings, M.P. (Malvern) said he had nothing to do administratively with the City of Worcester, and he would therefore say nothing of its sanitary plans, as he thought the most valuable contribution that could be made to a discussion by them all was to speak of facts known to themselves. He had had, as Chairman of the Police and Sanitary Committee of the House of Commons now for seven years, session after session, a number of applications with regard to the disposal of sewage. He had heard the ablest counsel of the Parliamentary bar argue on the different views of various applicants, and he had listened to a number of expert witnesses of the highest authority in this country. He was bound to say, whether it be from defect of intellect on his part or not, that he had never yet been convinced that any one of those systems for the disposal of sewage which had been brought before him possessed the excellence which was claimed for them. He had never yet been able with a clear conscience to sanction the expenditure of public money for the adoption of any one of them. He had had two instances before him in which he had been convinced of the successful application of sewage to the land: one of those was Croydon, the other was Reading. When the borough of Croydon applied to his committee a few years ago for a bill with regard to their sanitary works, they showed, in his opinion successfully, that their system of the disposal of sewage was satisfactory in more ways than one: that it was satisfactory with regard to getting rid of

the sewage, which after all was the great thing, and in the next place that it was got rid of without detriment to the health of the population who were living near the sewage works, always a very important point in the question. With regard to Reading, he never heard any evidence more convincing than the evidence given in that case, and the farm there was worked by natural irrigation, and was perfectly successful. It was not more successful than Croydon, but it was as successful in the application of the sewage and in the results that followed from it. It was only because he had in some way or other been convinced of the real and true results in those two cases, and had not been convinced with regard to other systems, that he was bound to say, as he had said in the chair of his committee and as he had said now, that as far as he knew the only system by which they could in every way dispose satisfactorily of their sewage, was by placing the liquid sewage, where they had the means to do so, perfectly fresh directly upon the land.

Mr. R. Godfrey (Birmingham) said there was no wonder at the sewage farm at Croydon being a success, considering that they had 600 acres of land at their disposal.

Dr. A. Carpenter (Croydon) wished to explain that the whole of the land was not in use at one time. There were only about 400 acres under irrigation, and the rest being used for other purposes connected with the farm, only 200 under absolute irrigation at the same moment.

Mr. R. Godfrey (King's Heath) repeated that the area at Croydon was equal to an acre per 100 persons of the population. Mr. Willis-Bund had asked what river the effluent under the Amines process had been put into. As yet the process was only an experiment, and he had simply given an account of what he saw to challenge criticism. No rivers had been tested with it yet. He claimed a fair trial for the process. With regard to its effect in dealing with chemical sewage, West Ham and Stratford-le-Bow were both towns making a good deal of chemical refuse, and it could be tested there. Most of the speakers had praised other systems of which they were in favour, and had said nothing in criticism of the Amines process. Let them give it a fair trial. If it failed it must fail; but it ought not to be condemned untried.

On "A Method of Regulating the Maximum Discharge of Sewers," by Henry Law, M.Inst.C.E., F.R.Met.Soc.

In designing a system of drainage, it is frequently required to limit the quantity which one or more of the sewers shall be capable of discharging at their outfall.

In the case of the formation of joint boards, for dealing with

the sewage of several separate districts, it is usual for the Local Government Board to prescribe two hundred and fifty gallons per house per diem, as the quantity which the joint board shall make provision for receiving into the main intercepting sewer from each branch or district sewer.

Also, in the case of the drainage of only one district, it becomes necessary to limit the quantity which the sewers shall discharge at their outfall or junction with the main sewer, as the case may be; not only because in the treatment of the sewage, whether on land or by chemical process, it would be impossible to deal with the whole of the discharge from the several tributory sewers in times of heavy falls of rain, but further because the main intercepting sewer would become of inconvenient dimensions if made capable of receiving the aggregate maximum discharge of all the sewers which it intercepted.

It is proposed to fulfil this requirement in the following manner:

The discharging capacity of a sewer is always proportional to the cube of the transverse sectional area filled by the sewage, divided by the wetted perimeter. This quotient gradually increases as the depth of the stream in the sewer increases, until it reaches a certain height (which, in the case of a circular sewer, is equal to 0·9496, the whole diameter being unity), after which, as the sewer becomes further filled, this quotient diminishes, and the quantity discharged becomes less.

If, however, the form of the sewer above the line of the maximum discharge is modified in such a manner that, as the sewage continues to rise in the sewer, the quotient obtained by dividing the cube of the area filled by the wetted perimeter remains constant, then the quantity discharged by the sewer will also be constant—neither increasing or decreasing—although the height of the sewage may vary between certain limits.

The accompanying drawing, Fig. 1, exhibits the form to be given to a circular sewer above the line of maximum discharge in order to render the discharge equal in quantity, although the sewage may rise above that level; and the following table gives the width of the sewer at each successive hundredth of the diameter above the line of maximum discharge, the diameter of the sewer being unity, namely:—

Width at the line of maximum discharge	0·4376
„ „ 1 hundredth of dia. above the same ..	0·3984
„ „ 2 hundredths „ „ ..	0·3632
„ „ 3 „ „ „ ..	0·3317
„ „ 4 „ „ „ ..	0·3037
„ „ 5 „ „ „ ..	0·2790

Width	at	6 hundredth	of dia.	above the same	..	0·2574
„	„	7	„	„	..	0·2386
„	„	8	„	„	..	0·2225
„	„	9	„	„	..	0·2090
„	„	10	„	„	..	0·1979
„	„	11	„	„	..	0·1891
„	„	12	„	„	..	0·1824
„	„	13	„	„	..	0·1777
„	„	14	„	„	..	0·1748
„	„	15	„	„	..	0·1735
„	„	16	„	„	..	0·1724
„	„	17	„	„	..	0·1714
„	„	18	„	„	..	0·1706
„	„	19	„	„	..	0·1699
„	„	20	„	„	..	0·1693

Having determined the maximum quantity which it is required for the sewer to discharge at its outfall, such dimensions must be adopted for the sewer, for a certain length from such outfall, as shall enable it to discharge that quantity when the sewer is filled to the line of maximum discharge, and above that level the sides of the sewer must be made of the form shown in the diagram.

At the upper end of this length of sewer, an opening is made in the side of the sewer forming an overflow weir, the level of the lip of which is the same as that of the line of maximum discharge, that is to say, the same as the lower limit of the height of the stream having the constant rate of discharge; and this sewer is made of such a length that, when the stream rises to the upper limit of such constant rate of discharge, the quantity which will flow away over the weir, shall be equal to the maximum quantity which the upper portion of the sewer can bring down, after deducting from the same the constant quantity which can be conveyed away by the lower length of the sewer with the modified form of section. This discharge from the weir is conveyed away by an independent channel provided for that purpose.

Fig. 2 illustrates the practical application of the method. If, for example, the diameter of the lower or regulating length of the sewer is 2 feet, with a fall of 1 in 500, its maximum discharging capacity would be 590 cubic feet per minute; and if the diameter of the upper portion of the sewer above the weir is 3 feet, with the same fall, its maximum discharging capacity would be 1643 cubic feet per minute; consequently, 1053 cubic feet per minute would require to be discharged over the weir; and if the length of the weir is 22 feet, this quantity would be discharged with a depth of 4·42 inches flowing over the lip of the weir. Therefore, with the

maximum quantity which the upper sewer could bring down, the sewage could never rise in the regulating sewer above the upper limit of constant discharge.

If the upper or regulating portion of the sewer were made in stoneware, moulded to the required form, as shown in the diagrams, no special skill or care would be required in the construction of the sewer.

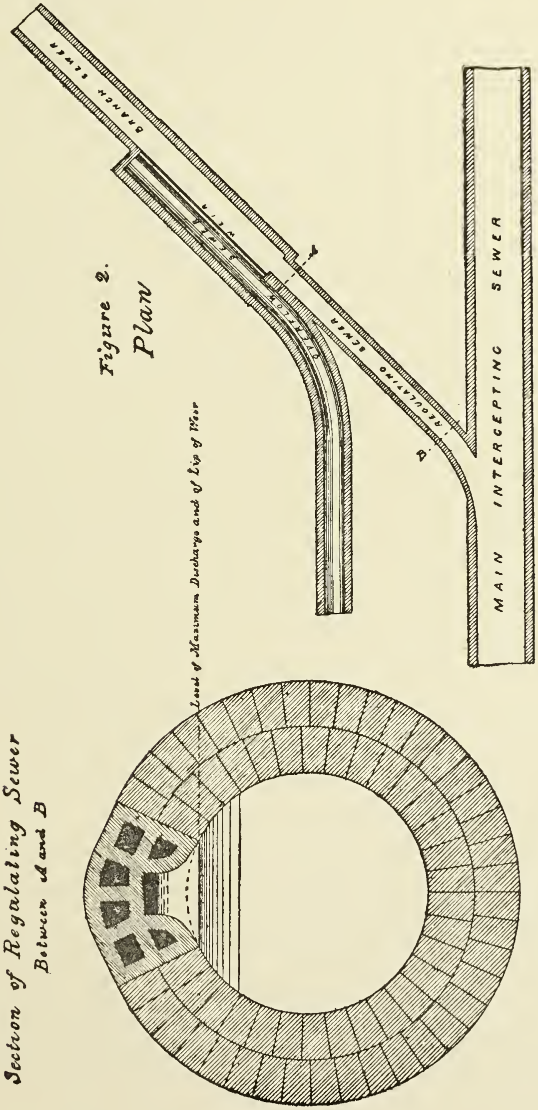


Figure 2.
Plan

Figure 1.
Section of Regulating Sewer
Between A and B

"*Notes on Water Supply*," *by* Richard F. Grantham, M.Inst.C.E.

The tendency of the population of the country to move towards the towns, and the consequent rapid increase of the already densely-populated quarters of towns, enhances the responsibility of those who are charged with the duty of supplying wholesome water, especially as new sewerage works, particularly in their connection with the houses which the growth of towns makes necessary, may become, without great precautions, means of contamination of the water, to say nothing of the chances of pollution at its source.

It may then be as well to note what has been done, and what is being done, in some of the larger towns towards providing wholesome water, and to refer briefly to the systems and methods which are most efficient in affording a good and sufficient supply.

The Rivers Pollution Commissioners declared that "of the different varieties of potable water the best for dietetic purposes are spring and deep well waters. They contain the smallest proportion of organic matter, and are almost always bright, sparkling, palatable, and wholesome, whilst their uniformity of temperature throughout the year renders them cool and refreshing in summer, and prevents them from freezing readily in winter. Such waters are of inestimable value to communities, and their conservation and utilization are worthy of the greatest efforts of those who have the public health under their charge."

The geological formations which in this country yield the largest supplies of deep well water, are the new red sandstone, the oolites, and the chalk.

Now it is almost unnecessary to point out that the largest towns in the kingdom are dependent to some extent upon water drawn from deep wells. London, Liverpool, and Birmingham, derives each of them a portion of its supply from deep wells, the former from those in the chalk, and the two latter from those in the new red sandstone.

In the case of London, the proportion drawn from deep wells and springs varies from about 13 to 15 per cent. of the whole supply. Liverpool and Birmingham have hitherto depended still more largely upon deep well water. Thus Liverpool, with a population of over 600,000 at one time derived 6,250,000 gallons per day from deep wells, out of a total of nearly 18,000,000 gallons, the remainder being obtained from gravitation works, consisting of seven catchment reservoirs, with a storage capacity of 4,059,000,000 gallons. The supply,

however, has been found insufficient, and the drought of 1887 was severely felt.

Birmingham in 1885, with a population of about 500,000 was supplied from deep wells in the new red sandstone at the rate of 9 million gallons per day, and from streams at the rate of 7½ million gallons. The storage capacity amounted to 617,761,913 gallons, equivalent to 10,000,000 gallons per day for 60 days in addition to the daily supply.

Birkenhead, with a population of about 45,500, derives an ample supply from deep wells also in the new red sandstone.

From the same formation, the South Staffordshire Water Works, which supply an area of about 40 miles in length between Stourbridge and Repton, and about 12 miles in breadth at Lichfield, in 1869 obtained 10,000,000 gallons daily, and this was increased to 24 millions by driving a tunnel into the keuper sandstone and marls and pebble beds.

Croydon, Surrey, with a population of nearly 100,000, is supplied with water of excellent quality from wells and headings in the chalk; and Portsmouth, with a present population of 150,000, has just got supplied at constant high pressure with 5,000,000 gallons per day from springs in the chalk. Other districts are drawing large and unfailing supplies from deep wells in the same formation.

Large volumes of water are also to be found in the oolites, from which, for example, Peterborough, Northampton, Scarborough, and Cirencester draw their supplies.

These instances, which may be taken as typical, show that while for the largest towns these sources alone are inadequate, for towns of more moderate size they yield an unfailing supply independently of dry seasons.

Experience of late years has shown that supplies from such water-bearing strata, as the new red sandstone and the chalk, can be better supplemented and increased by the extension of headings or adits driven horizontally below the water-level, than as was formerly the practice by deepening wells or bore-holes. By driving headings into the water-bearing strata, the area of collection of the water is increased in proportion to the length of the headings. Percolation of the water through chalk being along fissures and crevices in the rock, great care should be taken that no pollution is allowed to take place on the surface of the ground below which the water is drawn.

The boring of deep wells has been much facilitated and the cost reduced, by the recent introduction of boring tools of large diameter. Thus, in the new works in the chalk whence Southampton is supplied, tools were employed which bored two wells, each 6 feet in diameter.

But it must be borne in mind that water taken from deep wells, in a permeable district, is so much water abstracted from the sources of neighbouring streams. Schemes have been propounded by which the underground stores of water might be replenished by the admission of the surplus or flood-waters of rivers into "swallow" or "sump" holes, or "dumb" wells sunk into the water level below; but the recovery of the water at the particular locality in which it may be required, can scarcely be depended upon, and this, coupled with the disadvantage of pumping up again water which might have been collected and stored on the surface, make it difficult to see at present what practical benefit could be derived.

Comparing the various sources of supply in respect of quantity, we know that reservoirs fed from gathering grounds must have very ample storage capacity to provide against long droughts. Liverpool, which has hitherto been largely supplied, and Manchester and Sheffield, which have been entirely supplied from this source, felt the drought of 1887 severely. The magnitude of the new works designed for the two former towns shows what large provision is felt to be necessary for the wants of the rapidly-increasing populations. Thus, the storage (available for Liverpool) at Lake Vyrnwy will be about 12,000 million gallons; the present population being 814,873, and the consumption during the year 1887, twenty-three gallons per head. The storage at Thirlmere (for Manchester) when the lake is raised fifty feet, will be 8,130,686,693 gallons; the present population being about 1,000,000, and the present consumption about twenty gallons per head. Deep wells, although alone within a circumscribed district insufficient for the largest towns are certainly sufficient for towns of populations, say of 100,000 or 150,000, and supplies from rivers—taking London and Worcester as examples—do not anyhow fail during dry seasons, whatever their liability to pollution.

Upon this point, with reference to London, it is interesting to turn to the reports of the Water examiner. In November, 1884, the late Colonel Sir Francis Bolton remarked that at that time, after two dry winters and a spring of unusual drought, there were about 410,000,000 gallons passing over Teddington weir. Adding 80,000,000 at present abstracted by the companies, the quantity at Teddington would be 495,000,000, that is, the companies are taking less than one-sixth of the minimum flowing volume. Unfounded statements appear to have been made at that time that the Thames showed signs of exhaustion, but, he adds, "the fact is there is no question of present exhaustion; but in future times, when more than double the present quantity is required, it will probably become necessary

to store in some of the valleys sufficient of the winter or flood waters to give out in compensation during the dry months."

I may remark here that Worcester, with a population of 40,000, is now pumping 1,250,000 gallons per day from the Severn, which, even in the longest drought, yields an unfailing supply.

Later on, in September, 1887, the present Water Examiner of London, General de Courcy Scott, reports as follows:—"The extension of the deep well and adit system of supply within the Thames and Lee basins is much to be desired, as the water derived from the chalk by such water works is of the highest quality, and efforts in this direction on the part of the companies cannot but be viewed with much satisfaction. . . . A marked feature of river supplies is the very large increase of impurities, both suspended and in solution, which results when the rivers are in flood. Water taken from the underground sources, whether from the gravel already referred to, or from deep wells, is free from this defect."

Now let us turn, by way of example, to the statistics of the population of London, the quantity of water used, and the means which in many places have been adopted to prevent waste.

The population of London supplied by the different Water Companies is, according to the June Report of the Water Examiner, about 5,575,507, and the daily quantity of water varied from about 153,617,000 gallons, or 27·76 gallons per head in December, 1888, to 180,878,000 gallons in June, 1889, or 32·44 gallons per head.

In many towns much waste of late years has been prevented by careful supervision, repair of fittings, and the adoption of the waste water meter system.

I have tabulated the results of these improvements in some towns as reported from time to time by the Managers, Secretaries, and Engineers of the various Water Companies or Corporations.

Name of Town.	Quantity of water used before adoption of system per head per day. Gallons.	Quantity used after adoption of system per head per day Gallons.	Total Reduction per head per day. Gallons.
Carlisle	40	23·50	16·50
Lambeth W. W., London	34	20	14·00
Gloucester	31	17	14·00
Bath	43·7	22	21·70
Clevedon	37	23	14·00
Abergavenny	37	21	16·00
Newport	35	19·50	15·50
Birkenhead	35	15·48	19·52

Or more than 33 per cent. on the whole.

There are some towns, however, in which it has been considered that the first cost of adopting a system of preventing waste would be greater than the saving effected by it.

I do not say whether or not the system is practicable throughout London, although it has been adopted with advantage by the Lambeth Water Works, the New River, the East London Water Works, and other London Companies; but the large figures applicable to London are useful as a very striking illustration of the immense importance of the saving to be thereby effected. Thus, if the supply per head per day could be reduced from 30 gallons, taking that as the average, to say 20 gallons, there would, of course, be a saving of about 55,755,100 gallons per day.

The proportions of the daily supply used for various purposes at Liverpool and Manchester respectively are, of the 23 gallons for Liverpool :—

$\frac{1}{3}$ for domestic purposes.
$\frac{1}{3}$ for trade purposes.
$\frac{1}{3}$ waste (this latter is inevitable).

Of the 20 gallons at Manchester :—

13 gallons for domestic purposes.
7 gallons for trade.

The supply of water by meter is frequently advocated as a means of checking waste; but the detriment it is likely to cause to the public health, when applied for domestic purposes, by inducing people—particularly of the poorest classes—to use it as little as possible, outweighs, I think, any advantage it might offer in other respects. But for trade purposes it appears to be the most just and reasonable method; and, according to the recent case of Cooke, Sons & Co., *v.* the New River Company, the right of owners to demand such a measurement of water when used solely for business purposes, has been established.

In some maritime towns, attention has been drawn to the use of sea-water for watering streets and flushing sewers as a means of saving the cost of obtaining the best water for such purposes. In a paper read by Mr. S. H. Terry, of the Local Government Board, before the Civil and Mechanical Engineers' Society, it appears that several surveyors of those towns pronounce salt water to be the best for watering streets. The East London Water Works have for some time used unfiltered water for such purposes, although it involves separate main pipes.

Where towns use river water for all purposes, the efficacy of the system of filtration is of course of the highest importance. An advance has been made of late years in the means of testing

it by the methods of biological examination, which has so largely engaged the attention of Dr. Percy Frankland. General Scott shows by his Report of December last how much he values the bacteriological test, which for sanitary purposes he considers the more sensitive and delicate one.

Chemists appear to be agreed that sand filtration is the most efficacious, as it is the least costly, method of purification on a large scale. The conditions under which the removal and destruction of micro-organisms are facilitated, are an enlarged storage capacity, a sufficient thickness of sand, a slow rate of filtration—one according to the practice of the London Water Companies—not exceeding 540 gallons through each square yard of sand in 24 hours, and a frequent removal of the filtering medium.

Prominence, however, must be given to Mr. William Anderson's experiments on the filtration of the impure water of the River Nethe for the supply of Antwerp. The first attempts were with a certain thickness of sand, and below this a mixture of spongy iron and gravel. The action of the iron was thoroughly effectual, but it was found the filters became so quickly clogged, that only a part of the water would filter through, and so the labour of cleansing the filter was seriously increased. Mr. Anderson subsequently devised revolving cylinders charged with scrap iron, and so arranged that the water passing through them was brought into contact with every particle of iron.

With regard to the general question of obtaining a sufficient supply of wholesome water, there is a tendency of the largest towns to look to lakes as the best and most unfailing sources. Two schemes of such a character, for the supply of London, were brought before the Royal Commission on Water Supply in 1866, but it was objected that though there was no doubt the lake districts were a very fine gathering-ground for soft water, these districts were not unlikely to be claimed as the most natural source of supply for large and increasing manufacturing populations in the north of England, for whom soft water would be particularly valuable; and so far as Manchester is concerned this opinion seems to have been prophetic.

For smaller towns not situate on water-bearing strata, it is unfortunate that in so many cases the rivers, which after all are to a large extent fed by the overflow from under-ground waters, and which, as we have seen, generally yield unfailing quantities, should be rendered unfit by the pollution which is now allowed to exist. If only this pollution could be stopped, or at any rate minimized, and improvements made in filtration, we might, in many cases, look to the rivers as furnishing sufficiently wholesome supplies.

In conclusion, I wish to render my best thanks to Mr. Purchas, of Worcester; Mr. Deacon, of Liverpool; Mr. Hill, of Manchester; and to Mr. John Taylor, of the Lambeth Water Works Company, for much valuable information about the water supplies of their respective towns.

Mr. C. H. Cooper, Assoc.M.Inst.C.E. (Wimbledon), thought Mr. Grantham had under-estimated the amount of water at present derived from borings for the supply of London. The Kent Water Company took all its supply from the chalk; the East London and New River Companies took a large part of their supply from the same strata. Lately the Southwark, Vauxhall, and other companies had also sunk wells. The suburbs round London were largely supplied by private borings in addition to those belonging to small companies. Recently he visited Portsmouth with the municipal engineers, and saw the splendid supply of chalk water furnished to that town; no softening process was used, but the water was remarkable for its transparency. He agreed with Mr. Grantham that headings were a much surer means of getting water than the sinking of narrow borings. Chalk water contained a large amount of organic matter of a very remote origin; and Dr. Percy Frankland had found that such water, although containing a very small number of micro-organisms when first exposed to the air, after the lapse of a few days contained a far larger number of such organisms than were to be found in ordinary water. There was no doubt that where water came from an artesian well it was practically free from contamination; however, in open wells such as draw-wells, there was liability to contamination. At Croydon, where such wells existed, although lined with iron tubing to prevent percolation from the subsoil, Mr. Baldwin Latham showed, by trial holes surrounding the pumping station, that surface water got into the wells. Croydon has since sunk wells at Addington. He was sorry Mr. Grantham had not alluded to the intermittent system which prevailed in some parts of London: cisterns were fixed inside the houses, where they were subject to contamination, and often remained for years without being cleaned out. Many such cisterns were placed underneath floors of bedrooms, where they caught the dust which fell through the crevices when the floors were swept. Legislation is much needed to prevent the contamination of underground water; for while the purity of rivers, lakes, &c., is protected by the Rivers Pollution Prevention Act and the Public Health Act, no enactment has ever been passed to protect the purity of underground water, from which many millions of inhabitants of this country derive their supply.

Mr. H. R. Newton, F.R.I.B.A. (Weybridge), thought it a matter of regret that more attention was not paid to utilising as a means of supply the water which fell from the clouds. They were too largely

indebted to what might be called the manufactured article. Every drop of water which came from the sources of the rivers was derived from the heavens, and no doubt before it was rendered impure was extremely drinkable. He thought that the effect of the water, in the state in which it came from the clouds, on our internal economy might be very beneficial.

Mr. H. S. Ridings (Walthamstow) doubted the desirability for towns of a rain-water supply collected from the roofs of houses. He resided for some time at Carthagena, in South America, where they depended entirely upon the rain, which was stored in large reservoirs built underground, and the results were not at all satisfactory. The water quickly became filled with micro-organisms, which produced most painful diseases. As to the East London Water Works, he could say from observation that they were perfect models. Great advances had been made in many respects since Mr. Bryan had control of them. He had just completed a very remarkable pumping-engine at Waltham Abbey, for pumping the water to High Beech, in Epping Forest; it was a triple expansion engine, similar to those used in great ocean steamers, and he (the speaker) believed this was the only case in which they had been used for such a purpose. The economy in their use had been very great. Mr. Bryan had also lately succeeded, in the parish of Walthamstow itself, in getting through a difficult quicksand that he had been fighting with for the last eighteen months; by means of cast iron cylinders he had now got through it into the chalk. Walthamstow had a population of nearly 50,000, and one part of the town had a constant supply of water from the chalk, the beneficial effects of which were very marked indeed.

Mr. R. F. Grantham, M.Inst.C.E. (London), said Dr. Black's conjecture, that sewage was sometimes annihilated by freshets in a river, was very probable; but the best thing was to keep the sewage out of a river, and not trust to freshets. As to whether micro-organisms would be dangerous to life if retained in filtering beds and sent out again, he would only point to the case of London, where the filtering was very carefully done and where he never heard of anything of that kind occurring. To suppose that typhoid fever was carried down the Severn from Kidderminster to Worcester—which was more than twenty miles—by water was entirely opposed to the theory of Dr. Tidy, who maintained that after water had travelled a certain distance it became so oxydised that there was very little danger of disease being communicated in that way. In reply to Mr. Cooper's suggestion—that he had under-estimated the deep well supply of London—he might say that he based his estimate on the report of the water examiner, whose percentages were no doubt very carefully ascertained, and they might be taken as correct. Water from the chalk was no doubt of excellent quality, but it was hard, and in some cases softening processes were applied; they were not in use, however, at Portsmouth or Croydon, and at Croydon, as he knew, the water was excellent. He was glad to say that in London

the intermittent was being superseded by the constant system of supply, and now three-and-a-quarter millions out of five millions of the population had the advantage of the improvement. As to a rain water supply, as far as his experience went, it could not be relied on as a nice water, though it might not be unwholesome. He remembered a house in the Lake district, close to Morecambe Bay, which depended on rain water, and though there were few houses near it and no smoke, when they took the rain water in a glass it showed a black colour ; in fact it was contaminated by the deposit on the roof of the house itself, and it was difficult to obtain water in that way without contamination of that kind.

Mr. H. J. Marten, M.Inst.C.E. (Wolverhampton), said, as further local instances of large underground supplies being obtained for water-works' purposes, he might mention that 3,000,000 gallons of water a day were being obtained for the supply of Wolverhampton from a bore-hole sunk into the new red sandstone, and the East Worcestershire Water Company had a well at the foot of the Lickey Hills, the yield of which was over 1,000,000 gallons a day. He was interested in what Mr. Ridings said about the East London Water Works, because it was there he (Mr. Marten) had received his early training with respect to water engineering. Mr. Bryan had informed him that the engine he had recently erected at Waltham Abbey raised no less than 135,000,000 pounds of water one foot high with the consumption of one hundred-weight of coal ; that was about 27 per cent. higher duty than the best of the old water-engines at the East London Water Works had hitherto done.

On "Baths for the People," by Charles Clement Walker, F.R.A.S.

Great and praiseworthy as the progress has been within the last thirty or forty years of the means of cleanliness by baths of various kinds, it is not too much to say that the great mass of the labouring classes are still without these advantages. The term, "The Great Unwashed," though in a somewhat modified degree, may still be the description of the labouring classes, not only of our own country, but that of every country in Europe. In populous towns, public baths (consisting as they do of the Turkish bath, the various descriptions of shower, needle, douche, and other kinds) are for those parts of the community who are not what is termed "the labouring class." The ordinary warm bath and the public swimming bath are

usually within the scope of the artisan, the youth, and the unmarried men of the labouring class; but it will be found on investigation that the married labourers and their families make little use of them; the reason being that the price charged, though so low, is too much for their means. The 2d. or less for the swimming bath is still too much, and this bath has the disadvantage of only being used in summer, whereas, for sanitary purposes, people must be cleansed as perfectly in winter as in summer.

Now, when we consider the circumstances of the labouring class, we find that while they are children the mother can wash them at home, but as they grow up to young men and women this is not possible to be continued by themselves, on account of decency; so that except the young men get a bath in a canal, stream, or other piece of water, they generally go uncleansed from year to year, until cold water over their bodies is a repulsion.

It is quite impossible to lower the prices ordinarily charged for the warm bath and the swimming bath without considerable loss. It may be stated generally that public baths often do not pay their expenses. What, with the interest on cost of construction and the expenses of maintaining them, they seldom "pay." In Birmingham, for example, the interest on cost of construction and expenses in working amount over receipts to about a ½d. in the £ on the rates; and in many other large towns a similar condition of things exists. Valuable as are the results for this addition to the rates, it is not to be expected that the ratepayers will bear a further increase, to make up the loss from a further lowering of prices to meet the wants of the labouring class.

Now, while this is the case with our large and populous towns and cities, it is much worse in smaller towns and semi-populous districts all over the land, which form a much larger population in the aggregate than those towns and cities. The cost in the first instance of building baths is so great that it can rarely be undertaken, and if done by private munificence the cost of maintenance over the receipts is so much, that when it is taken into consideration it prevents the establishment of public baths for any class whatever, so that unless a much cheaper construction of baths and less expense of maintenance be found it seems quite unlikely that such populations will ever have the conveniences of larger towns.

The writer often had these thoughts weigh on his mind while being associated with a somewhat large works in a semi-populous district at Donnington, near Newport, Shropshire, but saw no chance of mending matters until the latter part of last

summer, when the idea occurred to him to provide baths for his work-people, upon the plan now before the section. But as people do not take kindly to baths in the winter, the construction was deferred to the spring of this year, and they were ready for the 1st of June. It must be remembered that the ordinary warm, or slipper bath, however good, is not the mode of cleansing that the labouring classes best understand, or will be persuaded to generally use; and if periodical cleansing is to be aimed at, the warm bath is not the most suitable.

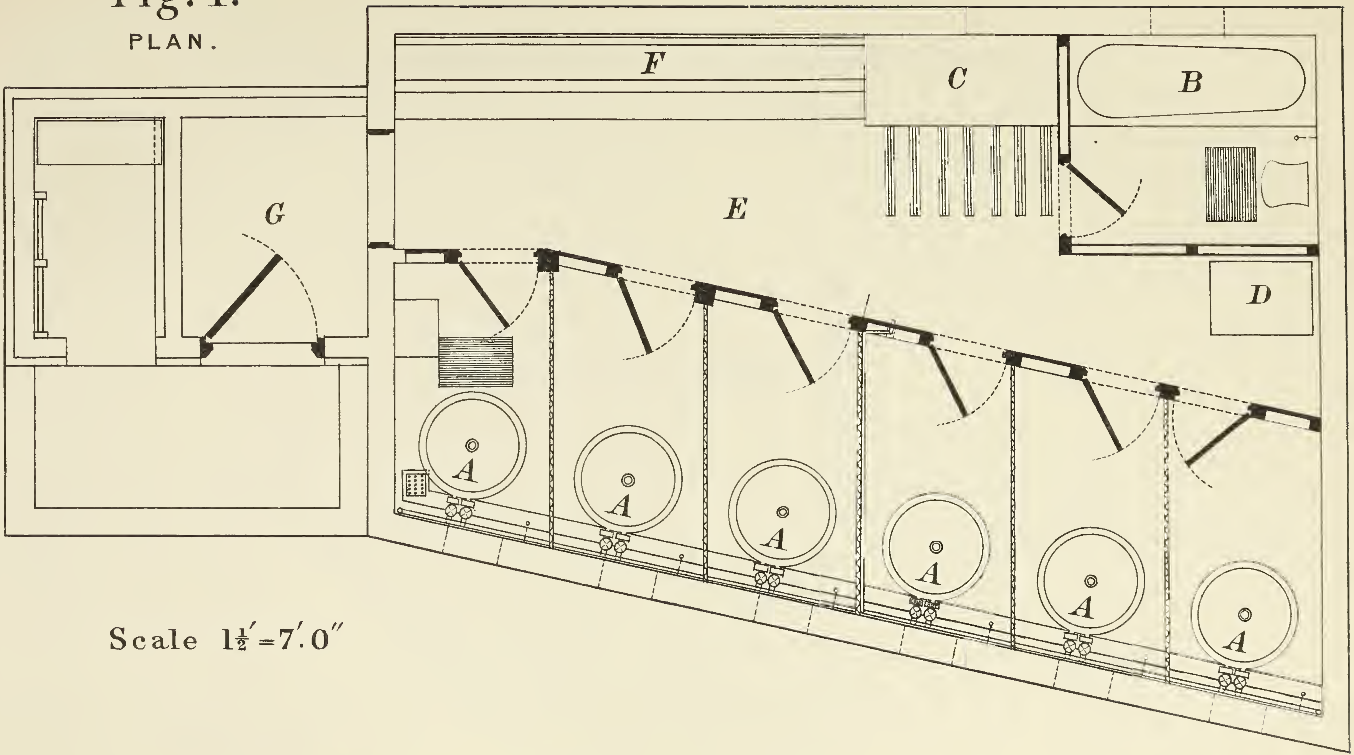
Without further preface, the baths before the section will now be described. A special point was made that everything should be done in the most complete and comfortable manner, with a minimum cost, for it is quite impossible that limited populations, without rates to draw on, can have palatial buildings. What was aimed at was completeness and efficiency, with strict economy in construction and working.

Fig. 1 shows the plan. The space of ground most suitable was of irregular form—hence the peculiar shape of the plan of the building. This is only apparent on the drawing, for to the ordinary eye it is neither seen outside or inside. It is 25 feet long, the width being 18 feet 6 inches at one end, 13 feet at the other, 10 feet 3 inches high to the wall-plate, and 17 feet 9 inches to the ridge. The roof is of galvanized corrugated iron, ceiled with deal, painted blueish white, lined with hair felt. The space is amply sufficient for six *ordinary* baths, as they will be styled in this paper, one warm bath, a drying closet of seven horses for towels, a washing machine, and all the apparatus for working the baths, and has a very clean, neat and comfortable appearance. The six ordinary baths, *A*, are arranged on one side in compartments, with doors in front. The warm bath is at *B*, the drying closet is at *C*. The washing machine is kept at *D*, and when in use is drawn out to the area *E*. A seat, *F*, is placed for persons waiting for baths, and has a board on the floor to place their feet on in case they wish to finish their dressing outside after the bath, to save time. There is a porch *G*, with door to prevent draught; and as many workmen and labourers came in dirty from their work, it was found that their dirty hands soiled all they touched, so an addition has since been made to the porch, with a washing vessel and towels to wash their hands before entering the bathhouse; and as their boots are often loaded with dirt, an iron grating is placed outside, level with the ground, to rub their boots on as they walk, and this, with mats inside, keeps all clean.

Each bath chamber is 8 feet long, 4 feet wide, and 7 feet 6 inches high, which gives ample room. The partitions are galvanised, corrugated iron, stiffened at bottom with angle iron,

Fig. 1.

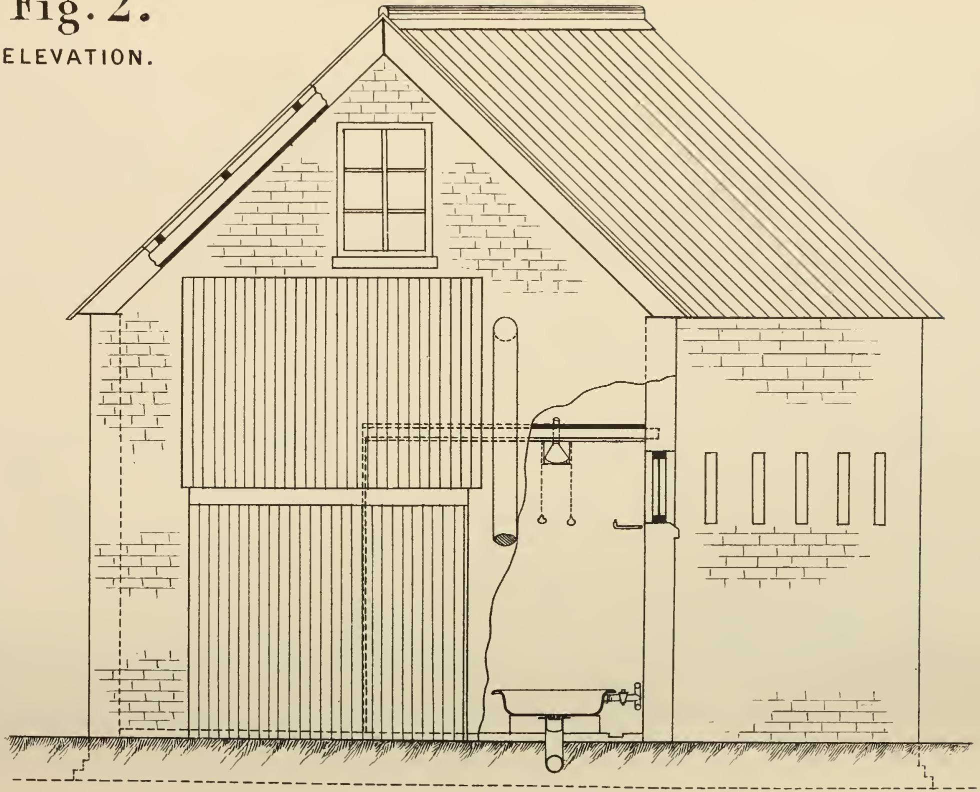
PLAN.



Scale $1\frac{1}{2}' = 7'.0''$

Fig. 2.

ELEVATION.



Scale $1\frac{1}{2}'' = 7' \cdot 0''$

the hollow spaces of corrugations between which are filled with cement to prevent accumulations of soapy dirt. The ceiling is of varnished deal, and forms the floor above, on which the tanks and pipes are placed that work the baths; and as this has a considerable weight to support, substantial wood posts are fixed, each with an iron shoe at bottom, to prevent decay; and as decay is so common in bath-houses, no wood is allowed to come in contact with the quarried floor, which is flushed with a hose daily, the floor having a slight inclination to the channel-drain at side, and soon dries.

Each ordinary bath is of cast-iron, 2 feet 6 inches in diameter by 8½ inches deep; the top rounded off smooth, so that it can be sat upon; and they are set 5 inches above the floor, being found more convenient for either sitting in, or for cleaning the feet while sitting on the stool. There is a wood grating on the floor for the bare feet. These baths have several coats of white paint on the inside. Enamelled iron would have been preferred, but it was found too expensive. Each compartment has hooks for clothes; and to prevent the common custom of throwing the towels on the floor, a hook is placed for them marked "Towels." And that the floor may not be made dirty by the boots being thrown anywhere, a place in a corner is marked "Boots." There is a dish for soap, and a box with two flesh brushes and flannel. Each bath door is numbered. There is a rough glass light at the end, with sliding pane for ventilation, and a gas jet. Over the centre of each bath is a rose above, with two chains, marked "Warm" and "Cold," for the spray. This rose has fine holes, not so large as is used for showers, for as we have to accustom the labouring class to the use of cold water, a shower from a large-holed rose is absolute horror, they cannot bear it. But with the fine spray it is absolute enjoyment, and all speak in the highest terms of how they like it. It is no small matter to teach the labouring class to love cold water. Each bath has two cocks with handles from the hot and cold water mains, being severally marked "Hot" and "Cold." As the bathers supply themselves with water, a black line is painted on the side of the bath 3½ inches from the bottom, to show the height to fill the water. This is found to be quite enough, as the water from the spray falls into the bath. Proper directions are in the bath-room how to use the bath.

As white glazed bricks are so expensive, the walls have three coats of white paint to prevent absorption.

The bottom of the bath has a plug 2 in. diameter. At the bottom of the recess in which it fits, a grating is fixed to prevent pieces of soap getting into the 4 in. iron main drain-pipe to which

it is bolted, all joints being "faced." This pipe goes through the building, and is sealed outside; there is no smell whatever from it.

The warm or slipper bath is full sized, of the usual kind, of enamelled tinned iron with Shanks's best fittings. The room has a chair, with wood grating and carpet. It has also a warm and cold spray.

On the floor over the baths is a hot cistern, 4 feet 6 inches by 3 feet 6 inches, by 3 feet deep, with tubes through it heated by steam, and is covered with wood. This cistern supplies hot water to the baths, the cold water supply being from the main. The warm spray is supplied from another cistern 4 feet by 2 feet, by 2 feet deep, and covered with wood. Both these cisterns are encased in wood lined with dry hair felt ½ inch thick, and it is found that they do not lose more than four or five degrees of heat during the day. The cold spray cistern is 3 feet 3 inches by 2 feet 2 inches, by 2 feet deep, and is supplied by a pipe from the main, with a ball cock. All the warm water pipes for the spray are covered with felt. As there is a W.C. in an adjoining building there has been no necessity to provide one. The total cost of the whole complete has been £220.

The steam used to heat the water for the baths is the waste steam from the works adjoining, which, after having heated the boiler and cooking apparatus of the workmen's dining hall for 400 men, and heating the hall, makes the water 180°. This is in use for about eight months of the year, but during the height of summer the waste steam is turned off, as it makes the buildings too warm, and the steam direct from the boilers is then used. For these eight months the cost of heating the water is nothing, and for the remaining four months the cost of the fresh steam is but small. If the baths did not have this steam to draw upon, a separate boiler would be required; but so small a boiler would be sufficient, that an addition of £15 would cover the expense. Two hundred large bath towels are necessary for these baths, and with a stock of flesh brushes, flannels, and sundries, will cost £10. So that a bath establishment, complete in itself, of this size, with washing and drying apparatus, costs £245 to £250.

I have tried to form an estimate of what population such baths would be sufficient for. These six are capable, without difficulty, of furnishing 18 ordinary baths per hour. They have supplied 24 baths per hour, but this was found to give pressure. It will probably be found in a town, that an extra warm bath would be desirable, each bath supplying two per hour in addition to the above 18. I think such a bathing establishment would supply the needs of a town of 12,000 inhabitants with ease.

As all the apparatus is ample size, if more ordinary baths were wanted the addition of a few more baths of this character would be a moderate expense, as their cost is less than half of the warm or slipper bath.

After the baths were used for a month by the persons engaged at the works adjoining, and were found to be so much appreciated and enjoyed, the public were admitted on the following terms:—

Ordinary bath with one large bath towel, use of flannel and two flesh brushes	1d.
Warm bath and two towels	4d.
Extra towel	½d.
Soap tablets	1d.

It was thought better for each person either to bring his own soap, or buy it.

The experience in the working of the baths is that five ordinary baths are paid for one warm bath. The time that the ordinary bath takes is found to be twenty minutes, while half an hour is necessary for the warm bath. The next important fact is that on an average the ordinary bath consumes eight to nine gallons of water, while about forty gallons are necessary for the warm bath. So thoroughly are the bathers cleansed in the ordinary bath, that although they come very dirty from their work, the towels used for drying themselves are returned scarcely soiled.

The directions given for the use of the ordinary bath are that the bather is to fill his bath with hot and cold water, to his own liking, to the line painted on the side of the bath, and if he likes to wash his feet first, he can sit on the stool with his feet in the bath. After which he is to stand upright, pull the warm spray to wet his body all over, and use plenty of soap with the flannel, rubbing himself well, particularly the head and feet. Then use the flesh brushes well, back and front, washing all off with the warm spray, repeating it if he likes. Then when finally cleaned all over, to pull the warm spray and wash all the soap off, and always ending with the *cold* spray, so as to obtain a good reaction, after which he dries himself with the towel, washing the flannel and brushes, and pulls the plug in the bath, rinsing it out clean for the next comer while dressing. Thus the baths work themselves. It is found that everyone uses the cold spray, and speak of the enjoyment of it in the highest praise.

Expenses of Working.

This is a matter which has been carefully considered. If these baths are in a large town, it will be found economical to have a much larger number of them, so as to make it worth

while to employ a man constantly, or what is better, a man and wife as bath-keepers, the wife doing the washing and attending to the women's baths. But for a town of say 12,000 inhabitants or less, it should be arranged that the bath keeper have some other occupation, which is his main dependence, and be paid for attending to the baths. The set of baths now described are kept by a labouring man, whose chief occupation is the charge of the workmen's dining-hall referred to; and in the time he has to spare in the morning, he fills the cisterns and heats them, which keep their heat the whole day. This does not take more than a quarter of an hour. He then washes the towels; he gives out the tickets for the money received for baths as required; and prepares a warm bath when asked for. It is found so few come after 6.30 P.M. in the semi-populous district where they are situated, that the baths are then closed, when he flushes out the whole place with a hose, and cleans up for the next day, which occupies him thirty or forty minutes. For this he is paid four shillings per week. This sum, with the soap required for washing towels, the cost of heating the water, wear and tear of towels and brushes, is the cost of working the baths. There is a profit on the soap sold and extra towels. So moderate is the cost of construction and the expense of working that if a person brought his own towel and soap, one halfpenny may be charged for the bath. I see no reason why these baths should not return a moderate interest on their cost, instead of being a loss as public baths generally are. They have now been in operation nearly four months without the least hitch. Everything is so substantial and well made that very little repairs will be required. Once a year the ordinary baths will want two or three coats of enamel paint, and these are all the current expenses.

At present the baths are used only by men and boys. If women are admitted, it must be at set times, when a woman will be in attendance; but for this size establishment it will not pay to have a separate set of baths for women.

Mr. Fletcher (Bolton) said he was much indebted to the author of the paper for the details of an excellent establishment. They would help him to carry out an idea which he had long entertained, and which, in the good days in store for a better educated country, might come to be by law compulsorily put into practice in all industrial establishments. He should like to establish a bath which several hundred colliers could use in the space of half-an-hour, and where they could leave their working clothes to be dried, damp as they generally are at the end of a shift in a hot and dusty mine from

moisture, either internal or external. They would then appear in public undistinguished by the rags and dirt, which could not fail to be humiliating. Such a bath would save the introduction into the men's homes of the odorous working clothes, and would render easy the complete washing of themselves, which, when performed at home, could be accomplished only under difficulties. He thought that could not be done under £1000; and last Christmas day, which he and his men had spent together, he had described this idea to them, and made them a promise that it should take practical shape. His idea was that of a cold and a warm shower for general use, with a locker for each man to hold the clothes, towels, &c., heated to drying point by steam. A tank of soapy water might answer better than soap cakes. That was the idea which had formed itself in his mind; and a swimming tank, heated by the waste steam, would be a great addition. The privacy of Mr. Walker's baths might be worth the cost in his case, but would be unattainable at a colliery, where several hundred men would use the bath daily and nearly all at once, between the hours of three and four o'clock in the afternoon. He was very much indebted to Mr. Walker for having led the way in this matter, and hoped to try and follow him.

Mr. Ernest Turner (London) said there was an effective system of bathing in use in the German army, which, however, was subject to the disadvantage that the men had no body of water into which they could plunge their hands, and no convenience for washing their feet.

On "The Technical Education of Plumbers," by H. D. Mathias, R.P.C., Liverpool School of Science.

This paper pointed out the importance of the technical education of plumbers; and a long discussion followed on the advantages of the examination and registration of plumbers.

On "Antiseptic Ventilation for Hospitals and Sanitoriums," by S. M. Burroughs.

The object of the invention or system shown is to first filter the air, then to regulate its temperature, then to propel it to any room desired, and lastly to render it antiseptic.

After a careful examination of the various systems of ventilation by forced circulation, I have selected that of the Sturte-

vant Blower Co., of London, as being most suitable for the application of my invention, because it can be made to blow air to any part of a building by means of sheet iron or tin pipes.

The blower consists of a revolving fan having several blades parallel to the axis. It can be run by a steam engine which can also be utilized for lifts, electric lights, centrifugals in laundries, mills for grinding, &c. The waste steam from the engine supplies the heat, excepting perhaps for a large building, when it can be supplemented by live steam.

1. The air can be drawn down a chimney or shaft, and is filtered through a coarse strainer to remove the larger particles, and through finer material to take out fine dust, fog, and smoke.

2. If the air is of the right temperature it is drawn directly into the blower, but if it requires to be heated, a damper directs it into a rectangular box of sheet iron packed with tubes containing waste steam from the engine, or live steam from boiler, or both. In circulating round these tubes the air becomes heated, is drawn through the blower, and propelled through main and branch pipes to any or every part of the building.

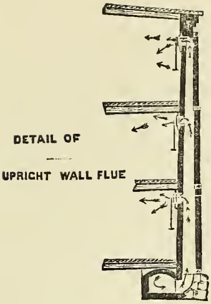
3. If only one antiseptic or air medication be desired at one time it may be distributed from the main pipe, but a different medication can be used for each room if required.

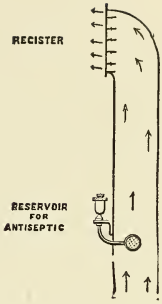
4. A volatile antiseptic may be conveniently introduced by means of suitable mechanism, by means of which the liquid can be made to drop regularly on pure sponge or other absorbent or distributing material, from whence it is readily absorbed by the current of air. Pinol, eucalyptia, pumiline, creolin, carbolic acid, thymol, or other volatile antiseptic, can be readily employed in this manner.

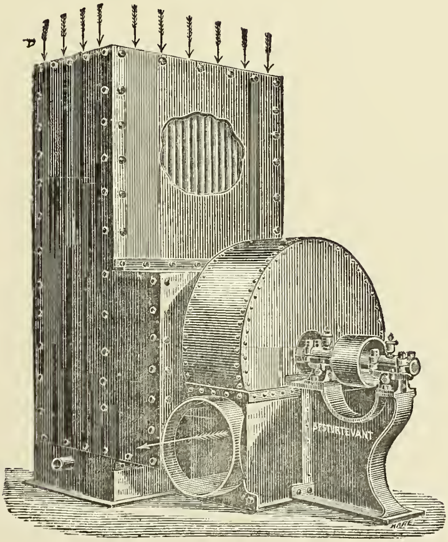
5. If the air is too moist or too warm, it can be both dried and cooled by causing cold water to pass through the pipes referred to instead of steam. The object of the invention is to enable hospital physicians to exactly control the temperature and to medicate the air, having previously deprived it of dust, &c.

The apparatus is not secret or patented, and can be used freely by any one.

This apparatus constitutes the most economical system of heating buildings with which I am familiar. As a system of ventilation, it appears to be the most effectual; while for the antiseptic treatment of consumption and germ diseases, also for making antiseptic the surgical wards of hospitals, it possesses advantages over inhalers and personal appliances, as it does not interfere with the natural breathing.







Mr. S. M. Burroughs (London) said there was a machine working very satisfactorily at Snow Hill Buildings, London. It made the air of all the rooms in the building antiseptic by simply pouring a few drops of the liquid into the receptacle. There was no patent on the machine, and it had been used in factories of all sorts where there was much dust. For instance a powerful blower in the neighbourhood of a planing machine in a wood factory would immediately clear out the dust, and even large substances weighing as much as a pound, if placed in the blower.

Mr. Simmons (Bristol) asked if there were any control over the filter so that there should be no draught.

Mr. S. M. Burroughs (London) said the air was usually directed up against the ceiling or across the ceiling. His experience was that

he got no draught at all when the air was blown in as warm as the air of the room. In answer to the further questions he said the same apparatus would be useful for the extraction of vitiated air as well as forcing in fresh or warm air; but it was more practicable to employ the system of forcing air in. The filter consisted of about 25 yards of cloth, so arranged that the air passed through it, and the dust was collected. As there was always such a pressure of air blown in with a good deal of force from this apparatus there could not be any draught coming in from the windows or doors, and that would be a very desirable thing in hospitals. The air as it came into the room was a little warmer than that in the room. That being so it naturally went to the top and created no draught. He had observed in connection with the blower that when they blew in cold air they were likely to feel a slight draught, but with warm air, which rose to the top, there was no draught. The air was taken down about 30 feet, and it could be made to go into pipes for heating, or it could be sent direct into the blower if the outside temperature was desirable. If driven by a small engine the blower could attain great velocity, and it could be used to heat as well as ventilate rooms. For this purpose it was very economical. If the steam engine were used for other purposes, and the waste steam were employed for the blower, the heat would cost nothing at all. The hot air could be blown into any part of the building where desired.

Sir Douglas Galton, K.C.B. (London) said that if warm air were supplied at the upper part of the room he could understand that there would be no draughts; but such a method should be attended by some system of extracting the air also, and not merely trusting to the chance of escape of air through the windows if they were to have a really healthy room. He thought they should have outlets to provide the constant circulation of air, without which there could be no very satisfactory ventilation. He quite saw the advantages in this system, and he should like to have further facts as to the point just raised—that it was a more economical method of heating than that of steam or hot-water pipes. He could quite understand that in a hospital ward or school buildings especially a system of ventilation analogous to this would produce a circulation, and provide infinitely healthier schoolrooms than now existed. To the ventilation of schools their attention ought to be very largely directed, because they were in a most unsatisfactory and unhealthy condition.

SECTION III.

CHEMISTRY, METEOROLOGY, AND GEOLOGY.

ADDRESS

By John W. Tripe, M.D., M.R.C.P.E., &c.

PRESIDENT OF THE SECTION.

"*Winds, with some remarks on their Sanitary Effects.*"

I have selected this subject for my address, not only as it is one belonging to meteorology, but because winds are necessary to the well-being, if not to the existence of the animal world. Thus, if it were not for winds, the air we breathe would not be changed sufficiently often to support vigorous life. There are also other reasons for introducing the subject at a meeting of the Institute, viz., that winds frequently carry infectious matter to a distance from the source of infection.

The earth is enveloped by an atmosphere, consisting chiefly of oxygen and nitrogen; but it contains in addition varying proportions of aqueous vapour, carbonic acid, various products of imperfect combustion, dust, spores, baccilli, and other microscopic bodies. In its rotation the earth carries the atmosphere with it at the same speed as itself, so that there would be but little wind if the surface of the earth were not unequally heated by the sun's rays. As the sun is always vertical over some part of the earth, on either side of the equator, it heats that portion of the earth, and consequently of the atmosphere above it more than elsewhere. And, as heated air is lighter than cold, it ascends and creates a vacuum when cold air rushes in to fill its place. There is, therefore, always a lower current of air from the poles to the equator, and upper currents from the equator towards the poles or other colder regions. The latter currents becoming colder in their transit, descend at a greater or less distance from the equator, thus creating winds. In addition, as the earth rotates more rapidly at the equator

than it does at the poles, in consequence of its nearly globular shape, the velocity of the atmosphere is about two hundred and fifty miles per hour greater at the equator than near the poles. As one other result of the varying speed at different parts of the earth's surface, all winds have a tendency to be deflected to the right. Northerly and southerly winds in the northern hemisphere are deflected in a north-easterly and south-easterly direction, inducing a north-east trade wind in the northern and a south-east trade wind in the southern hemisphere. Where two trade winds meet at or near the equator, there is a region of calms. The currents returning towards the poles to replace the air that has gone towards the equator to form the trade winds, assume a more or less south-easterly direction in our hemisphere, and a north-westerly in southern temperate latitudes, and have been named by Sir John Herschel the "Anti-trades."

The direction of the winds in the cyclones of subtropical seas, is, as regards north and south winds, partly determined by the rotation of the earth, but chiefly by unequal heating through local causes of limited portions of land or water. Where the heated air rises there is diminished pressure, as shown by the barometer, and cold air consequently rushes in from all directions to fill the vacancy; that which comes from the poles travels the slowest, and that from the equator more rapidly, owing to the different velocities with which the surface of the earth rotates. As before stated, the polar wind in our hemisphere is a north-easter, and the equatorial a south-west wind; when these enter the place of low barometric pressure they assume a cyclonic direction, rotating towards the north-west to south-east, and then again to north, or contrary to the motion of the hands of a watch. Winds from the west or east have no effect on the rotatory movement of a cyclone.

As the behaviour of land, under the heating influence of the sun's rays, differs much from that of the sea in the reception and power of retaining heat, the force of the wind varies very much according to the surface on which the heat falls. When the rays strike upon water they penetrate to some depth, but a large portion of the heat absorbed does not affect the thermometer, as it becomes latent, and is known as "the specific heat of water." The sea and large bodies of water, therefore, do not become so highly heated as land with the same amount of heat. The water of the sea especially is nearly always in motion, and thus leads to the diffusion of heat in the water, so that the surface is not so hot as it otherwise would have been. Evaporation also goes on with greater or less rapidity according to the rate of movement and dryness of the air, and thus reduces the temperature of the sea. Land, on the other

hand, retains the greatest part of the heat for a time, and gives it off slowly, but does not become heated to so great a depth as the sea. Some kinds of soil hold the heat more than others, especially sand and rocky grounds, whilst a wet soil does not become heated so much as dry, partly because the moisture absorbs much heat, which becomes latent. Ground covered with vegetation does not become so hot as it otherwise would do, because part of the heat is used in growth and part given off by the evaporation of its moisture.

There is a constant change of wind morning and evening at the sea side, forming what are known as land and sea breezes. The ordinary theory for these is that in consequence of the unequal heating of the sea and land already referred to, the air rushes from the cooler to the warmer localities, causing sea-breezes by day and land-breezes at night. Mr. Laughton, however (Jour. Roy. Met. Soc., Vol. 1), doubts this being the true explanation, as it does not fully elucidate the chief phenomena of a sea-breeze. Thus, Dampier remarks that the effect of the coming sea-breeze upon the water is marked by "a fine black curle," which advances slowly, so that it can be seen perhaps for an hour before the breeze reaches the shore, when it has usually a velocity of not only 5 or 10 miles, but frequently of 30, 40, or even 50 miles an hour. Mr. Laughton believes them to be winds of propulsion rather than of aspiration, and that the causes are, first, that the heat of the sun induces increased evaporation at sea; and secondly, causes increased elastic force of the vapour in the air, so that pressure is exerted on the land air, which is then driven back in the direction of least resistance. After the sea air has been pouring on to the land until nearly evening, and has ascended high into the atmosphere, it becomes cooler, and descends towards the warmer sea, forming the land-breeze. He says these breezes are most marked in the vicinity of well wooded districts, and are scarcely perceptible when sandy deserts are near. Mr. Blanford (Vade Mecum., part 2, page 70), is dissatisfied with this explanation, and offers another, viz., that the air over the land having been expanded by the heat, forces its way upwards, and thus compels the heavier air to slide off towards the cooler sea, causing a locality of high atmospheric pressure some distance away. From this place the air flows towards a locality of diminished pressure on the heated land. At night a reverse flow takes place towards the warmer region, viz., the sea, causing a land-breeze. The Rev. F. W. Stow (Jour. Roy. Met. Soc.) offers yet another statement, as he says that the direction of the wind from the sea obeys Buy's Ballot's law, so that when we look to the sea the wind comes from the right and blows along

the coast line. Whatever the explanation may be, land and sea breezes are generally met with at sea-side places, and make them not only more pleasant, but more healthy, than inland localities, especially in summer. This frequent movement prevents stagnation of the air, increases the evaporation of moisture from the body, and consequent removal of the effete matter given off in the perspiration and breath. Winds occurring in the vicinity of large rivers partake of the good qualities of sea-breezes, but do not contain so much ozone or saline matter. I may mention that these breezes are said to be rarely higher than 400 feet above the surface. As a corroboration of this, I may mention that on the second stage of the Eiffel Tower, about 450 feet high, there was a calm when the wind blew strongly on the earth, and on another occasion the contrary happened. These facts are within my own knowledge. Similar observations have been made on the Forth bridge.

Although wind charts show that the wind rarely goes in a straight line on the earth's surface, yet I believe, as each wind nearly always has its peculiar characteristics, that the following statements are fairly correct:—

The direction from which the wind comes influences materially our health and comfort. Thus, a north-easterly wind, so dreaded in this country in winter in consequence of its coldness and dryness, usually passes over the northern portion of Russia, including Siberia, before reaching us. In summer it is often pleasant, but very frequently treacherous, causing colds. Easterly winds which come from the direction of Russia and Germany are, as is too well known, dry and biting, having the character of a land wind a little tempered by the German Ocean. A northerly wind which blows from the locality of the Arctic Ocean, and when somewhat westerly, from Greenland, is cold, although bracing to the strong and healthy. Westerly winds which come from the direction of Labrador pass over so large an amount of sea before reaching us as to have lost most of the characteristics of a land wind. Due south, and especially south-westerly winds, are essentially oceanic in their character, being moist, comparatively warm, and in summer relaxing. Much of the moisture and heat are derived from the Gulf Stream. South-easterly winds are drier than south-westerly, as they pass over France, and often have their origin in Africa. By a dry wind, I mean one capable of absorbing a rather considerable quantity of moisture before it becomes saturated, or nearly so. The feeling of dryness depends not so much on the quantity of moisture contained in the air, as on its capacity of absorbing more. Thus, a wind at 40° F. nearly saturated, will contain much less moisture than a wind at 60° F. not nearly

saturated. The former would consequently feel damp, and the other dry. The quantity of moisture abstracted from our bodies by a wind will not only depend on its capacity of absorption, but on its rate of progress, so that a high wind will exert a greater evaporating force, with the same degree of saturation, than a wind having a lower velocity.

The results of the intermixture of different winds vary considerably at different seasons. Thus in winter we often have, even when the barometer is high, a heavy rainfall with a north-easterly or easterly wind. This occurs usually after the prevalence of fine weather and a southerly or south-westerly wind, owing to the cold air causing so great a reduction of temperature in the mixed air, as to render it incapable of holding all the moisture previously suspended. On the contrary, when easterly winds have continued for some time, and a south-westerly wind supervenes, a cloudy sky often becomes clear and the air drier, in consequence of the rise in temperature and, consequently, increased capacity for the retention of moisture. In such cases, the barometer often goes back from fair (30 inches) to wet (29 inches). As a rule, however, there is dry weather and a rising or high barometer with easterly winds, and rain with southerly or south-westerly winds.

The most convenient arrangement for discussing winds is that proposed by Dove, viz., Permanent, Periodical, and Variable, the latter being the winds of high latitudes. Permanent winds include the Trades and Anti-trades, to which I have already referred. They are stronger in the South than in the North Atlantic, blowing about eight knots in the former, and six in the latter. The chief Periodical winds are the north-east and south-west Monsoons, or, as they are named by Blanford, the winter and summer Monsoons. The direction of these winds varies to a certain extent, being locally changed in India by the unequal heating of the soil, where the south-west Monsoon, on reaching the valley of the Ganges, is changed into a south-easterly wind before passing over the hot surface of the Punjab. In China, on the contrary, it assumes a more southerly direction. I mention these facts to show that even a Periodical wind may become changed in its direction from local causes. In the same way the north-west Monsoon is changed into a north or north-east wind near Madagascar, and into a due west, or nearly so, at Torres Straits. At the time of change of the Monsoons, violent storms of wind and rain frequently happen. Variable winds are those which occur in this country, and, as all will admit, well deserve their name. They are not confined to this island, but are felt on those parts of the earth's surface which are outside the influence of the

Trades. They vary in their direction and force almost constantly, in consequence of the varying temperature and consequently varying air pressure in different localities, as they circulate round areas of high or low pressure.

Mr. Glaisher published a paper in the "Journal of the Royal Meteorological Society" (1870), showing the direction in which the wind blew in this country during 8,765 consecutive hours, which I shall now discuss, as well as other tables published by the Astronomer Royal for a longer period. I have reduced them to percentages, excluding calms.

Percentages of hours during which the wind blew from different points of the compass.

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	TOTAL.
Glaisher ..	10·1	12·4	7·4	7·0	7·9	33·1	15·2	6·9	= 100
Greenwich Reports.	12·3	14·4	6·8	6·0	10·3	31·4	11·5	7·3	= 100
Averages ..	11·2	13·4	7·1	6·5	9·1	32·2	13·4	7·1	= 100

This latter shows, as might have been expected, that by far the most prevalent wind in this country is the south-west, as on the average of the two sets of observations, nearly one-third (32·2 per cent.) blew from that quarter. The next most prevalent winds are the north-east and the west, which had the same percentages, viz., 13·4 per cent., or, to speak more exactly, 13·4 per cent. of north-east against 13·35 per cent. of west. The fourth place is occupied by the north winds, with 11·2 per cent. against 9·1 per cent. of due south winds, and 7·1 per cent. of east and north-west winds. As these percentages were obtained from a considerable number of observations—and the two sets do not differ much except as regards winds from due east and west—they may be regarded as fairly approximative, especially as they were taken in the same locality.

I now give a table prepared from Mr. Strachan's paper, published in the "Journal of the Royal Meteorological Society," on the percentages of winds blowing from different points of the compass on wet and on dry days. The number of observations was 3,148, each of which was made at 9 a.m. I have given percentages instead of the actual figures as published, for more ready comparison.

Percentages of observations on rain and wind on 3,148 *days.*

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	CALMS.	TOTAL.
With Rain.	6·5	12·3	11·0	4·9	14·2	30·5	15·7	4·0	0·9	= 100
Without Rain.	10·0	10·5	12·3	3·7	7·2	17·2	25·7	10·3	3·1	= 100

The table shows that with a north wind rain occurred on 6·5

days, and was absent on 10·0 days; with a north-west wind there were 10·3 dry and 4·0 wet days; and with a north-east wind there were 12·3 days on which rain fell and 10·5 without, making a total of 22·8 days with, and 30·8 days without rain, during the prevalence of northerly winds; the dryest periods being those during which north-west winds prevailed. On the contrary, the greatest number of wet days occurred with southerly winds, as there were 49·6 days of wet against 28·1 days without rain. The days in which south-west and south winds prevailed showed a smaller proportion of wet as compared with dry days than might have been expected, viz., 34·7 rainy and 24·4 dry days. South-easterly winds, comparatively, rarely occurred; and the number of wet and dry days were more equal, viz., 4·9 with rain and 3·7 without. The days on which the wind blew from the north-west were marked with much less rain than from any other quarter. Under these circumstances when anyone proposes to go for pic-nic or any other out-of-door enjoyment, I should advise him to select a day on which the wind blew from the north-west or the north, unless the latter were too cold.

Local occasional winds extend in some cases over large tracts of land or sea, whilst in others they are confined to some small locality. The winds to which I refer occur more or less all over the world, and are characterized by their violence and generally by their dryness. They are hot or cold, according to the surface over which they have passed; both of these varieties are met with in this country. The Helm wind, which occasionally occurs in Cumberland, is a notable instance of one kind; and sudden blasts of hot wind, such as one described by Symons, is another. He saw a tract or narrow passage, along which everything had been killed by a hot blast which passed across the land whilst a friend of his was taking a thermometrical observation. His friend noticed the thermometer rise rapidly, then felt a pain in the back of his neck, and had to lie down; on rising he saw a narrow path, along which everything was withered where previously all was green.

The Simoom is a deadly wind occurring occasionally in the deserts of Kutch and Upper Scinde, as well as in other like countries. Dr. Cooke, who lived many years in India, and in that part of the country, says it is often sudden and singularly fatal in its effects, "invisible, intangible, and mysterious." It is a dread to the desert traveller, as it sometimes causes sudden extinction of life, both in man and beast, and destroys all vegetation. He cites a case in 1851, when some officers in General Jacob's house at Jacobabad were awakened out of their sleep by a sense of suffocation and great heat. Next

morning the path of the wind was shown by the destruction of every green thing in the garden for a width of nearly twelve yards, and in a straight line. A native who was caught by one, stated that he and two friends were struck down and rendered senseless by a blast like air from a baker's oven. They all recovered after a time. When death occurs the flesh is withered and can be plucked from the bones. In one instance three out of five persons were killed.

The hot wind of Australia is better known, as it occurs in Sydney and the interior of the country, when the temperature rises to 107° F., or something a little less. Captain Sturt says that in Central Australia his thermometer rose to 131° F. in the shade. Dr. Mann, who made many observations in Natal, stated that he had not known the temperature higher than 97°, and that as many as from 26 to 30 hot blasts occurred in a year. They always commenced in the middle of the night and continued up to 9 or 10 in the morning, when the greatest heat was attained. About 12 or 1 at midday rain would begin to pour in torrents and the temperature to fall rapidly, sometimes 30° in half-an-hour. The rain usually continued until night, when the atmosphere became remarkably translucent, as stars of the seventh magnitude could be seen by the naked eye.

A similar wind occurs in New Zealand, which is followed by what is called a "*Southerly Buster.*" The effects of exposure to this is described by Lady Barker (Station Amusements in New Zealand). "The wind is parching and scarcely endurable, but at last, when the skin felt as if it were tightly drawn like parchment, and our ears and eyes had long been filled with powdered earth, the wind dropped as suddenly as it had risen five days before; clouds then came up rapidly with an icy breeze, followed in an hour by rain. The following day was delicious."

The *Föhn* is a hot dry wind which blows in winter in the north-eastern valleys of Switzerland. Mr. Laughton (Modern Meteorology) says that on a wind driving up a mountain slope, its expansion, owing to diminished pressure, causes a corresponding lowering of its temperature. The moisture is then condensed and the latent heat set free, thus warming up the surrounding air, making it relatively hot and dry, and forcing it into the valley below. The temperature rises sometimes to 80°, and the humidity decreases to about one-fourth part of that which the air could hold.

The *Sirocco* is another hot wind which is met with on the borders of the Mediterranean, especially the coasts of North Africa, Sicily, and South Italy. In Sicily the thermometer sometimes rises to 110°. It does not destroy life but destroys

temper, and causes an intense feeling of langour and prostration. The *Khamsin*, a hot wind of Egypt, lasts for forty or fifty days, and carries large quantities of fine dust many miles out to sea. The *Harmattan* is a hot east wind on the West Coast of Africa, which blows a reddish dust on to the sails and decks of ships far out in the Atlantic. In Spain a similar hot wind is known by the name of *Solano*.

Warm and hot moist winds are depressing and sedative in their action on the system, and diminish the elimination of moisture from the lungs and skin, and consequently of the organic matters ordinarily given off by these organs. Warm dry winds, unless very hot, produce a contrary effect, as they encourage the evaporation of moisture from the skin and lungs, being greedy of moisture. When very hot and dry, they remove water so rapidly from the body as sometimes to destroy life.

Occasional Cold Winds are almost as numerous as hot winds, and when accompanied by fine snow are called *Blizzards* in the United States of America; the *Purga* in the Yenessi Valley; and the *Bura* in Central Asia. They are much more destructive to life than the hot winds. In a *Blizzard* the snow falls in the form of fine dry crystals of ice, which do not melt readily, thus rendering respiration difficult, and sometimes impossible, eventually causing death by asphyxia. In April, 1873, a most violent *Blizzard* occurred in Dakota, when the wind blew at the rate of thirty-nine miles an hour for nearly 100 hours, so that no one could leave the house. This, however, was not so bad as the Blizzard of January 11th, 1888, which extended over Dakota, Minnesota, Kansas, and Texas, causing loss of life to more than 100 persons. Many of those who died completely undressed themselves, although the wind blew at the rate of from forty to fifty miles an hour. The temperature fell 50° in 4½ hours, and 64° in less than eighteen hours. On January 18th and 19th, 1881, a Blizzard occurred in London, when the crystals of ice found their way into the passages and rooms, although the doors, windows, and shutters were closed. I was out in the storm, and on returning found above an inch of the fine dry snow on the seat of a railway carriage, which it had not wetted. What are known as "*Northers*" in the United States are dry cold winds, often accompanied by snow. Mr. Russell, in his book on North America, says that the temperature during a "Norther" in Southern Texas fell from 81° to 18°, or 63° in 41 hours. Other cold winds are the *Mistral*, which blows along the Gulf of Lyons, and is so strong that an eye-witness told me that he saw a man blown off his horse, waggons overturned, and much damage done to vegetation. The

Bora and *Tramontana* are, like the Mistral, dry and cold, and sweep over the Adriatic and adjoining countries. In Peru, in a district called Punos, a table land having an elevation of 13,000 feet, Prescott says that the south-east Trade wind becomes so cold and dry before reaching this district, that the ancient Peruvians preserved their dead by exposing them to its desiccating action.

Easterly winds in this country are very trying, even to healthy persons, and often fatal to the old and young, causing more deaths in London, when combined with fog, in one week, than the most violent Blizzard. Thus, in three weeks of very cold weather with easterly winds, the deaths from inflammatory diseases of the lungs rose from 250 in one week to nearly 700 in London alone; and in 1886 the deaths from these causes increased steadily from 418 in February to 828 in the third week of March during the prevalence of these winds. When these winds are dry, they act injuriously by causing rapid evaporation of moisture from the skin and lungs, and corresponding evolution of heat from the body. When cold and moist, such a wind acts injuriously by carrying away heat fron the lungs and skin by conduction, and not by increased evaporation of moisture. This is the reason why a combination of great cold and fog is felt so keenly.

The velocity of wind is ordinarily calculated on land from Robinson's Anemometer, which consists of four hemispherical cups, firmly fixed on the extremities of two bars placed at right angles to each other, bolted together and perforated in the centre, so that when mounted on a standard they will revolve, and by means of gearing transfer the motion to a recording apparatus. The velocity of the rotating cups was supposed originally to be equal to one-third of the velocity of the wind, but this has been found to be too great; so that rather less than 2·5 is the factor for multiplying the velocity recorded by the apparatus. Anemometers do not ordinarily record any movement of the wind less than three miles an hour, but it is evident that records may be obtained by occasional puffs when the steady rate of three miles an hour has not been reached. A light air is defined by the Meteorological Office to be a wind moving at the rate of eight miles an hour; a light breeze of from 13 to 18 miles an hour; a moderate breeze 23; a fresh breeze 28; a strong breeze 34; a moderate gale 40; a fresh gale 48; and a strong gale 56 miles per hour. In a storm the wind is said to blow at the rate of 75, and a hurricane of 90 miles per hour.

General Greely, in his account of American weather (pp. 176–77), gives some extraordinary velocities observed in the

American Signal Service. He says that at Cape Mendreino a velocity of 144 miles an hour was reached in Jan., 1886; of 104 miles at Fort Canbig, Dec., 1884; from 90 to 100 miles on the North Carolina coast; and at Cape Lookout of 138 miles on Aug. 17th, 1879. The following also were recorded; at Pike's Peak 112 miles in June, 1881; 186 miles on Mount Washington, and also the rate for less than an hour of 110 miles on March 13th, 1888, at Montreal. In the same book he states that he had recorded a velocity of 65 miles an hour in the Arctic regions, when the cups were blown away. He estimates the gusts to have travelled on this occasion at the rate of 90 to 95 miles an hour.

Tornadoes in America usually come from the south-west and travel to the north-east. General Greely says that the path of greatest violence varies, generally, from 100 to 600 yards in width, and from 1 to 50 miles in length; that its rate of motion is between 20 and 50 miles an hour, and the time taken in the passage of the immediate centre is between 5 and 10 minutes, during which the largest trees may be blown down, houses and bridges lifted from their foundations, and frequently overturned. In a series of tornadoes on Feb. 9th, 1884, above 10,000 buildings were destroyed, 800 people killed, and 2,500 wounded. On Sept. 9th, 1884, the value of the property destroyed by a tornado in Minnesota and Wisconsin was estimated at 4,000,000 of dollars.

The relations between wind velocities and pressure were until lately in a chaotic state of confusion, but, thanks to Mr. Dines and his late father, we now have some definite information on the subject. They erected a whirling machine, driven at various rates by a steam engine. The machine consisted of a long bar, supported by stays, carrying plates of different shapes and sizes, and, for the purpose of comparison, a uniform velocity of 20·86 miles per hour was finally adopted. The results showed that with a velocity of 21 miles per hour the pressure exerted upon a plane area, of a fairly compact form, is about $1\frac{1}{2}$ lbs. per square foot. As the wind pressure up to a velocity of 70 miles per hour has been found to vary in these experiments as the square of the velocity, the pressure with any intermediate velocity can be readily calculated. If we take the pressure of 1 lb. per square foot as a basis, it is found that a velocity of 17 miles per hour gives this pressure. This varies, however, to a certain but small extent according to the size and shape of the plate.

As Beaufort's scale is used not only by seamen, but by most meteorological observers, to express the velocity of the wind, I give the table adopted by the Meteorological Office, and used in

the comparison of weather with storm signals, and by captains at sea :—

Force. Beaufort's Scale.			Approximate velocity. Miles per hour.
0. Calm			0— 5
1. Light Air, or just sufficient to give steerage way			6—10
2. Light Breeze...	Or that in which a well-conditioned man-of-war, with all sail set, & clear full, would go in smooth water from	1—2 knots	11—15
3. Gentle		3—4 „	16—20
4. Moderate		5—6 „	21—25
5. Fresh	Or that in which she could just carry in chase, full and by	Royals, &c.	26—30
6. Strong		Single-reefed topsails and topgallant sails	31—36
7. Moderate Gale		Double-reefed topsail, jib, &c.	37—44
8. Fresh „		Triple-reefed topsails, &c.	45—52
9. Strong „		Close-reefed topsails and courses..	53—60
10. Whole Gale, or that with which she could scarcely bear close-reefed maintopsail and reefed foresails			61—69
11. Storm, or that which would reduce her to storm staysails			70—80
12. Hurricane, or that which no canvas could withstand, 80 miles and upwards.			

There are, of course, serious difficulties, especially in steamships, in noting according to this scale, but observers on land can soon judge as to what place in these scales a wind at a given time should be assigned, but as wind comes in gusts, observations made only for a short period can scarcely be so useful as a continuous record such as that given by Robinson's or other anemometer. Mr. Laughton, however, objects to the velocity fixed for a calm as being too high, and says that anything like 5 miles per hour during a calm would be caused by occasional puffs of wind. Also that the highest is too low, as in tropical cyclones the velocity frequently exceeds 90 or 100 miles; and Mr. Thorn, judging from the damage done in these storms, is of opinion that the velocity often exceeded 120 miles per hour. This estimate agrees fairly well with Greely's statements.

Carrying power of winds.—Perhaps the most important evidence on this point was afforded by the Krakatoa eruption, which occurred on August 26th and 27th, 1883. An important volume has been published by the Royal Society, edited by Mr. Symons, giving full details of the phenomena. An immense column of smoke, steam, and ashes proceeded, on the 26th, from the volcano, and reached a height calculated at 17 miles by the captain of a vessel out at sea. The dust and ashes were caught by the wind and carried round the world in 13 days, as shown by the haze, the peculiar coloration of the clouds at sunset and sunrise, and the greenish colour of the sun and moon. After the first passage it was again carried round the world in less than 14 days, making the double passage in rather less than 27 days, so that it must have had a velocity of 76 miles an hour. The stratum was at first estimated by Mr. Archibald to be 121,000 feet, or 23 miles, above the surface of

the earth. It appeared to be far higher than ordinary cirri, and afforded spectroscopic evidence of being a cloud of solid particles. In November the cloud had expanded so as to include Europe, having at first been carried in a westerly direction over the Indian Ocean, Africa, Brazil, the Pacific, and thence back again to Japan. The density and elevation diminished during its passage, so that in January, 1884, the highest part had fallen from 121,000 feet to 64,000 feet, being a diminished elevation of 57,000 feet. The volcanic dust fell on several ships in September, 1883, one being more than 3,700 miles from the volcano at the time.

Another instance of volcanic ashes being carried a considerable distance occurred in March, 1875, when several ships at sea, and a large area in Scandinavia, extending from the Gulf of Bothnia to the West Coast, were more or less covered with a deposit of ashes. The matter was fully investigated by Professor Mohn, who concluded that they had been brought by the wind from the volcano Hecla, in Iceland, which was in a state of eruption. Numerous other instances could be given.

Chas. Darwin, in his "Naturalist's Voyage Round the World," mentions in several places deposits of dust which had been carried from 1,000 to 1,600 miles out to sea. On microscopic examination of some dust obtained near St. Domingo, it was found to consist in great part of infusoria with silicious shells, and of the silicious tissues of plants; and out of sixty-seven different organic forms, all but two were inhabitants of fresh water. The dust fell on his ship in such quantities as to dirty everything on board, to hurt people's eyes, and even to damage the astronomical instruments. He remarks (p. 5): "After this fact one need not be surprised at the diffusion of the far lighter and smaller sporules of cryptogamic plants." At p. 454, when speaking of Keeling Island, six hundred miles from Sumatra, he gives a notable instance of this kind. After mentioning various kinds of seeds he had obtained, which were unknown to the Malays settled there, he says: "All these are supposed to have been driven by the north-west Monsoon to the coast of New Holland, and thence to these islands by the south-east trade wind." The plants he obtained there are common littoral species in the East Indian Archipelago, so that the seeds must have travelled before germinating between 1,800 and 2,400 miles. The pollen of trees has at times so coated the ground as to have been mistaken for a "sulphur rain," as occurred in Friesland about sixty years ago; and showers of fish in inland places have been frequently recorded. The fish were usually of small size, but a shower of herrings is mentioned as having fallen in Edinburgh. The contents of fish ponds have been

also caught up by the wind and deposited some distance away. In 1804, the wind carried the wheat on a Tetuan threshing floor across the Straits of Gibraltar, and let it fall in Andalusia. The roof of a house was carried away in a storm, and deposited whole about one hundred yards away. A loaded waggon was lifted off a road over a hedge, and fell into an adjoining field. Very numerous similar occurrences could be given as to the lifting and carrying power of the wind.

One of the most interesting phenomena connected with the carrying power of the wind is the occurrence of water-spouts at some distance inland. One lately occurred on High Stoy, Batcombe, Dorsetshire, and is described in the June and July numbers, 1889, of Symons' Monthly Meteorological Magazine. About six in the evening, after a storm of thunder and lightning, with but little rain, great waves of water, from 8 to 10 feet high, rolled down the Batcombe Hills upon the little village of Chatmole. Great damage was done, stock having been drowned, trees carried away, roads injured for miles, the cottagers' furniture washed away, and other damage done. An eye-witness described the cause as a solid stream of water, about the thickness of a man's body, which washed holes in the ground 8 or 9 feet deep. The Rev. H. J. Poole states that the ground above these pits was undisturbed, there not being the slightest disturbance of the soil, although below them large holes were frequent. Mr. Symons observes that "it is much to be regretted that no record has been preserved as to whether the water was salt or fresh. Our impression is that it was probably sea water lifted from the English Channel by a whirlwind and dropped upon the top of High Stoy." These water-spouts are by no means uncommon, especially at sea.

There is one unpleasant experience which most Londoners and residents in large cities and towns have suffered from, viz., the quantity of dust, vegetable, and other debris which is blown at times by a high wind in our faces, and into the nose, mouth, and lungs, to the great injury of the mucous membranes lining these passages. I have treated many cases of illness arising from this cause. In the country hay fever and attacks of asthma are caused by the pollen of grass, and of some other vegetation, carried by the wind.

Winds are also carriers of ozone from the sea and country places to cities, and thus counterbalance, to a certain extent, injuries such as those just mentioned. Ozone is oxygen in a specially active and energetic state, which burns up much of the effete matter given off from the skin and lungs, and renders the air more pure and invigorating. When wind charged with ozone passes over a city the ozone is removed, as I showed in

1856 and '57, by observations conducted by myself at Hackney, and by the late Mr. Burge (Medical Officer of Health for Fulham), at Fulham. We then found that when wind containing ozone blew from Hackney to Fulham I noted ozone and he did not, and the contrary with wind from Fulham to Hackney.

The relations of wind to fog are well worth notice, as most fogs are of local origin, and are carried by the wind to the places where they occur. Thus, the "London particular" is usually the result of an admixture of mist from the Thames or sea, with the products of combustion given off from the fireplaces and furnaces of London. In Hackney we sometimes have fogs from the Lee valley and less frequently from the Thames. When the wind is scarcely moving the fog remains for a longer time than when it is brisk, as the fog is then blown away. Occasionally fogs come across the land from the sea as far as Hackney, and I have known spray from the sea to destroy the leaves of trees at Upper Clapton on the side exposed to the blast. I have on more than one occasion passed through a mist extending from the sea to London; and Dr. Burney Yeo, in his paper on "Change of air," just published, says that he has followed a sea fog from Ryde to Portsmouth, and thence by rail to London, where it became a London fog in the south-western districts, whilst the eastern districts were clear. He also says in his paper, after referring to dust carried by the wind backwards and forwards from place to place, and inhaled by every one out of doors, "and yet we marvel how infectious diseases are spread abroad!"

I have dwelt at considerable length on this part of my subject because I think it explains many otherwise unaccountable outbreaks of infectious diseases. In 1882 I gave evidence before the Hospital Commission on small-pox and fever hospitals, and then stated that I could not in any way account for the repeated outbreaks of small-pox in a street parallel with the Eastern Hospital, situated 400 feet away, and separated from it by the City of London Workhouse, unless they were caused by infective matter carried by the air and blown over the workhouse. In my report to the Hackney Board of Works for the year 1884 I discussed this matter fully, and as I think proved that an outbreak which occurred on the 21st and 22nd of March in that district had its origin on the 6th and 7th of the month, when the wind, after veering about, blew steadily at a very low rate of speed, or was calm, viz., about three or four miles an hour, in the direction of the localities affected. Mr. Power also pointed out in 1882, a similar coincidence as regards the wind and small-pox outbreaks in the vicinity of the Fulham Small-pox Hospital. During the epidemic of 1883—4

I identified several outbreaks of the disease in the vicinity of the hospital with periods when the wind was moving over those portions of the district at a very low velocity. High winds seem to blow infective matter away so rapidly, and diffuse it so extensively, that probably no harm has happened during these periods; but I believe the converse holds good when a low rate of wind prevails. Some physicians doubt the possibility of small-pox infection being carried more than a few feet, but I cannot understand how, if the disease be set up by a living organism falling on a soil in which it can develop, it should be able to infect a person at 20 feet distance, and not at 100 feet, or even at half a mile. Surely a living organism cannot be destroyed (oxidised) in its passage through the air for half a mile, when the wind is travelling at the rate of only four miles an hour, that is to say, in 7½ minutes. The idea seems to me preposterous, especially as we know that articles of infected clothing and scabs of small-pox will retain infective power for months. I believe the reason why zymotic diseases, and especially small-pox, are not more frequently spread by the wind to be that a certain dose or intensity of the poison, as well as a susceptible condition of the recipient, must co-exist to set up the train of symptoms constituting an attack of the disease.

Time will not allow me to do more now than to mention the spread of diphtheria and some other diseases by the wind, which has been insisted upon by several competent observers. I must, however, just mention the results of a careful and extended investigation as to the occurrence of diarrhœa and zymotic diseases in the vicinity of the Thames, which I made some time since, and concerning which I gave evidence before the Royal Commission on the discharge of sewage into the Thames. I then showed that these diseases caused fewer deaths in the vicinity of the river than at a quarter of a mile distant from it, owing, as I believe, partly to winds blowing away from the various streets and courts, the effete matters given off by the body, which are, I believe, injurious to health by affording pabulum for the growth of low forms of life. There are many other points on which I should have touched if I had not already exceeded the usual length of an address, and trespassed so long on your patience.

Mr. G. J. Symons, F.R.S. (London), said that there were one or two points on which he would like to say a word or two, because one did not like an address of this character to go *pro forma*. There was one of which they had had a very remarkable confirmation quite

recently, and it was respecting the monsoons. In Worcester there was an average rainfall of about 30 inches per annum, whereas more than that quantity fell in Hong Kong in a single day during the May monsoon of this year, which fact was a good confirmation of what Dr. Tripe had said regarding the monsoon rains. With regard to Dr. Tripe's reference to picnics, he might remind them it was necessary to make arrangements for a picnic a day or two beforehand. If they all knew *when* a north-east wind was going to blow they would be in a much happier frame of mind. As to the intensity of mistrals, near the Gulf of Lyons there was one remarkable fact that had not he believed been mentioned in this country, and he did not think investigated fully on the other side of the Channel, namely, the tremendous force of wind in that country. Over a line of railway running from Cette to Perpignan the wind swept so violently as to have overturned several trains as they were running along. True there had been isolated cases of trucks being blown over in this country. He might mention another thing with regard to the velocity of winds. Some people said before the Eiffel Tower was constructed that it would be useless, but no one thinks so now. It had only been erected a short time when the French Government established valuable meteorological apparatus on the summit, and the observations were recorded below, showing something like three times the velocity of wind at the summit as at the base, and also that the diurnal curve of wind intensity is wholly different. He would also like to make a remark as to the distribution of germs, and the opinion expressed by Dr. Tripe as to the condition of the recipient. He thought that if their own bodies were in a good sanitary condition they might swallow any number of those germs without danger therefrom.

On "*The Extension of Public Analysis*," by CHARLES E. CASSAL, Public Analyst for St. George's, Hanover Square, Kensington, Battersea, and High Wycombe.

NO one who has taken the trouble to consider the state of things which existed before the days of the "Lancet Sanitary Commission" of 1854–56, and prior to the Adulteration Act of 1860, can entertain any doubt as to the great benefits which have been conferred upon the community by the legislation directed against the adulteration of food and of drugs, in spite of the tentative character and of the numerous other defects of that legislation, and in spite of the inadequate manner in

which it has been applied. It is proverbial that things move slowly in this country, and although, as a set-off against this, it is generally asserted, perhaps with justice, that they move surely, the profound and general ignorance upon the subject of adulteration is a little astonishing, when it is considered that the matter has engaged the attention of English legislators from decidedly early times, in reference at least to the adulteration of particular articles of food. The first enactment directed against adulteration in this country dates back to 1267, and provision was made for the punishment of persons guilty of certain forms of food adulteration in 1580 and 1604; but, it cannot be supposed that the public generally had been at all moved upon the subject, until the appearance, in 1820, of Accum's celebrated work called "Death in the Pot," with a title-page embellished with urns, death's-heads, hour-glasses, serpents, and palls: "A treatise on adulteration of food and culinary poisons, exhibiting the fraudulent sophistications of bread, beer, wine, spirituous liquors, cheese, tea, coffee, cream, vinegar, confectionery, mustard, pepper, olive oil, pickles, and other articles employed in Domestic Economy, and methods of detecting them." And the public, if moved at all, were not moved to much purpose then, as no general Adulteration Act existed before 1860; and it is well known that the passing of that Act was almost entirely due to the startling revelations made by Drs. Hassall and Letheby—as members of the Commission previously referred to—in the pages of the *Lancet*. The Select Committee appointed by the House of Commons, in 1855, reported as follows as to the adulterants discovered at that time: "Without entering into voluminous details of the evidence taken, your Committee would enumerate the leading articles which have been proved to be more or less commonly adulterated. These are—arrowroot, adulterated with potato and other starches; bread, with potatoes, *plaster of Paris, alum, and sulphate of copper;* bottled fruits and vegetables, with certain *salts of copper;* coffee, with chicory, roasted wheat, beans, and mangel-wurzel; chicory, with roasted wheat, carrots, *sawdust, and Venetian red;* cocoa, with arrowroot, potato-flour, sugar, chicory, and some *ferruginous red earths;* cayenne, with ground rice, mustard husks, etc., coloured with *red lead, Venetian red*, and turmeric; gin, with *grains of paradise, sulphuric acid, and cayenne;* lard, with potato flour, mutton suet, *alum*, carbonate of soda, and *caustic lime;* mustard, with wheat flour and turmeric; marmalade, with apples and turnips; porter and stout, with water, sugar, treacle, salt, *alum, cocculus Indicus, grains of paradise, nux vomica*, and *sulphuric acid;* pickles and preserves,

with *salts of copper;* snuff, with various *chromates*, *red lead*, *lime*, and *powdered glass;* tobacco, with water, sugar, rhubarb, and treacle; vinegar, with water, sugar, and *sulphuric acid;* jalap, with *powdered wood;* opium, with poppy capsules, wheat flour, *powdered wood and sand;* scammony, with wheat flour, *chalk*, *resin*, *and sand;* confectionery, with *plaster of Paris* and similar ingredients, coloured with various pigments of a *highly poisonous nature.*"

This, as a matter of fact, is by no means a complete list of the adulterants said to have been detected at that time. It is not too much to say that the practice was almost universal, and a very striking feature about it was the dangerous character of many of the adulterants used. The list as it stands, however, is to be thought of not merely as proving the necessity of stringent legislative action, but as a description of the sort of thing which would, with certain exceptions of course, again occur if the existing laws were to be repealed or even relaxed. I do not suppose it will be seriously maintained that the commercial morality which devised and practised the forms of adulteration described, has suddenly vastly improved, and attained a standard of excellence upon which the country may congratulate itself. Certainly, matters are better now than they were twenty-five or thirty years ago, but if this be so, it is not owing to an epidemic of virtue in commercial life. If the adulterator is more virtuous now than he used to be, it is because he has, to some extent, been dragooned into virtue. Indeed, some members of certain trades nowadays not unfrequently make a virtue of necessity. We are accustomed to the frequent delivery of jeremiads about the spotless tradesman, whose last thought would be to undersell his neighbour, or to get anything illegitimate out of the public, and who has been dragged into court, held up to general obloquy, and mulcted in fines at the instance of a wicked public analyst—a form of complaint which is the more interesting when it is emitted, as is not unusually the case, by members of particular trades whose past history in reference to adulteration will not bear much investigation. Much of course depends upon education and consequent enlightenment. It may freely be admitted that some forms of adulteration would no longer be employed in the present day, because their employment was due merely to ignorance, and no special pecuniary advantages were attached to their use; but if it is contended that injurious and even actually poisonous adulterants are things of the past, it is only necessary, in order to refute the contention, to call attention to our past experience of commercial virtue in these matters, and to present facts. There is no difficulty in finding recent instances. Pepper containing

chromate of lead has recently been sold in Bristol; salad oil made up with mineral (or "paraffin") oil has been seized in Wandsworth; vendors of a sweetmeat called "chewing gum," made up with paraffin-wax, have been prosecuted in Birmingham; sweets coloured with red iron-earths have been taken in London; and there is the extending use of so-called preservatives, such as salicylic and boracic acids for perishable foods. The adulteration of drugs and the inaccuracy of prescriptions, may be cited as further instances.

It ought surely to be tolerably obvious that what law there is should not only be maintained, but that it should be applied as extensively as is possible. It is, of course, not likely that any change in the law in the direction of relaxation will take place. All the tendency of modern legislation is the other way; but the application of the existing law is still absurdly inadequate. It is supposed to be an expensive business, and local authorities, whose general devotion to the "penny-wise and pound-foolish" policy is notorious, object to spending money in order to institute and maintain a really thorough and comprehensive system for ensuring the purity of the various supplies which are required by the communities they are supposed to serve. On the other hand, there are not a few members of local authorities who appear to think that it is actually desirable for ulterior motives—so that, in fact, their own sordid interests may not be affected—to keep the Acts against adulteration in the dead-letter state. One has only to glance at the annual reports of the Local Government Board to become convinced of the necessity of enforcing an extension of public analysis, in so far, at any rate, as public analysis is now allowed to go; that is to say, in regard to "foods and drugs." In the whole of England and Wales, during the year 1887, only 24,440 samples of all kinds were taken for analysis, of which by far the greater number were samples of milk. In London generally, calculating upon the populations in 1881, about one sample for every 596 persons was taken, but in the provinces only about one for every 1,228 persons. In two populous districts of London, one having a population of 107,850 and the other of 17,508, no samples whatever were taken. In another, having a population of 36,024, eight samples were submitted, of which two were adulterated. Very insufficient attention is paid to the large "stores," of which there are now so many in London. *Not a single sample* was taken in the *county* jurisdictions of Berkshire, Oxfordshire, or Pembrokeshire, and the same was the case in not less than seventy-two boroughs—including Plymouth, Lincoln, Gloucester, Carlisle, Oxford, Colchester, Grimsby, Shrewsbury, Scarborough, and Devon-

port. To this black list must be added several other counties and boroughs where the application of the Acts was disgracefully inadequate and, in fact, no better than a farce; and in further quotation from the Board's report, it has to be stated that the provincial districts referred to—those where no samples were taken and those where hardly any were taken—contained in 1881 an aggregate population of more than *five millions.*

The table on the following page shows the total number of samples taken in the Metropolis and in each county, including boroughs, in 1887, with the populations and the proportion of samples returned as adulterated in that year and in 1886. The table, to a great extent, speaks for itself. It would, of course, be necessary to make a large number of calculations in order to determine with accuracy the relative degrees of inertia displayed by the authorities of the different counties, and it would hardly be worth the trouble. Some of the figures given, however, must appeal to all persons who are not entirely devoid of a sense of humour. Dorset, Shropshire, and Anglesea, for instance, with their eight samples apiece (being 1 for about 20,400 inhabitants in the aggregate), and the proud position of the county where one sample was taken which was found to be adulterated, thus giving 100 per cent. of adulteration, may be especially pointed to. Excluding the Metropolis, of the 54 counties in the list, it cannot be said that more than 14 have made any serious attempts to apply the Acts, and these 14 all contain large cities or boroughs.

—	Population, 1881.	Total. Examined.	Total. Adulterated.	Percentage Adulterated. 1887	Percentage Adulterated. 1886	—
The Metropolis.	3,815,704	6402	894	14·0	*13·2*	Metropolis.
Counties, including Boroughs.						Counties, including Boroughs.
Bedford	149,459	146	8	5·5	*7·1*	Bedford.
Berks	218,363	22	0	...	...	Berks.
Bucks	176,323	102	18	17·6	*13·1*	Bucks.
Cambridge	185,594	46	6	13·0	*9·8*	Cambridge.
Chester	644,037	669	96	14·3	*8·3*	Chester.
Cornwall	328,366	50	3	6·0	*6·5*	Cornwall.
Cumberland	250,647	136	7	5·1	*9·7*	Cumberland.
Derby	461,914	148	44	29·7	*18·1*	Derby.
Devon	603,595	174	23	13·2	*14·4*	Devon.
Dorset	191,028	8	1	12·5	*11·1*	Dorset.
Durham	867,201	739	86	11·6	*14·7*	Durham.
Essex	576,434	608	128	21·1	*14·5*	Essex.
Gloucester	572,433	612	38	6·2	*7·9*	Gloucester.
Hereford	121,062	34	2	5·9	*21·7*	Hereford.
Herts	203,083	78	8	10·3	*7·9*	Herts.
Hunts	59,491	34	2	5·9	*1·8*	Hunts.
Kent (ex-Met.)	709,482	776	103	13·3	*11·8*	Kent (ex-Met.)
Lancaster	3,454,441	4119	561	13·6	*12·8*	Lancaster.
Leicester	321,258	391	37	9·5	*10·7*	Leicester.
Lincoln	469,919	175	25	14·3	*15·7*	Lincoln.
Middlesex (ex-Met.)	369,929	737	78	10·6	*7·2*	Middlesex (ex-Met.)
Monmouth	211,267	47	8	17·0	*6·9*	Monmouth.
Norfolk	444,749	65	5	7·7	*6·7*	Norfolk.
Northampton	272,555	105	20	19·0	*13·1*	Northampton.
Northumberland	434,086	141	14	9·9	*12·2*	Northumberland.
Nottingham	391,815	120	49	40·8	*28·7*	Nottingham.
Oxford	179,559	......	...	...	*14·3*	Oxford.
Rutland	21,434	20	2	10·0	...	Rutland.
Salop	248,014	8	3	37·5	*31·6*	Salop.
Somerset	469,109	1134	53	4·7	*3·9*	Somerset.
Southampton	593,470	583	82	14·1	*13·0*	Southampton.
Stafford	981,013	1073	147	13·7	*13·3*	Stafford.
Suffolk	356,893	50	10	20·0	*23·1*	Suffolk.
Surrey (ex-Met.)	473,143	523	86	16·4	*19·2*	Surrey (ex-Met.)
Sussex	490,505	359	18	5·0	*7·1*	Sussex.
Warwick	737,339	1390	184	13·2	*9·4*	Warwick.
Westmoreland	64,191	60	4	6·7	*18·8*	Westmoreland.
Wilts	258,965	69	6	8·7	*7·1*	Wilts.
Worcester	380,283	168	18	10·7	*9·2*	Worcester.
York. E. Riding	364,979	307	21	6·8	*14·3*	York, E. Riding.
„ N. Riding	346,317	50	1	2·0	*4·3*	„ N. Riding.
„ W. Riding	2,175,325	1074	142	13·2	*12·5*	„ W. Riding.
Anglesea	51,416	8	2	25·0	*18·2*	Anglesea.
Brecknock	57,746	41	6	14·6	*37·8*	Brecknock.
Cardigan	70,270	3	0	...	...	Cardigan.
Carmarthen	124,864	13	3	23·1	*38·5*	Carmarthen.
Carnarvon	119,349	18	1	5·6	*29·2*	Carnarvon.
Denbigh	111,740	30	2	6·7	*16·7*	Denbigh.
Flint	80,587	17	5	29·4	*7·7*	Flint.
Glamorgan	511,433	745	68	9·1	*9·7*	Glamorgan.
Merioneth	52,038	9	4	44·4	*44·4*	Merioneth.
Montgomery	65,718	1	1	100·0	...	Montgomery.
Pembroke	91,824	......	...	...	...	Pembroke.
Radnor	23,528	3	1	33·3	...	Radnor.
Totals		24440	3134	12·8	*11·9*	Totals.

With reference to the percentages of adulteration shown in the foregoing table, I think every Public Analyst of experience will agree with me that an improved method of taking samples would in all probability very considerably affect those percentages in the direction of increase. To place the taking of samples in the hands of country police constables, as is done in most counties, is a good way of still further lessening the value of the Acts, and is a factor which, without doubt, affects the percentage of adulterated samples detected.

Since we are in Worcester, it may not be amiss to point especially to the Worcester returns, and I venture to express the hope that our visit here may do something in the direction of improving the existing condition of things.

In 1887, in the county jurisdiction of Worcester, with a population, according to the census of 1881, of 308,810, 133 samples were taken for analysis, of which eight were returned as adulterated. In the borough of Worcester, with a population of 40,354, sixteen samples were taken, and one was reported as adulterated. In Kidderminster, with 24,270 population, nineteen were taken, and nine of them were adulterated. In Bewdley and Droitwich no samples were taken (populations respectively 3,088 and 3,761). So that in the whole county, including four boroughs, with an aggregate population of at least 380,283, only 168 samples of all kinds were taken, of which 18 were reported against, giving a percentage of 10·7. Surely, this is hardly a creditable state of things, and it is but a poor excuse to say that other places are worse. The number of samples taken was equal to one for every 2,263 persons. With regard to the percentage of adulteration detected, I venture to think that the remarks previously made about the method of collecting samples will apply here with some force. There can be no doubt, from the lessons of past experience, that a very different story could be told after the application of some improvement in this direction.

I desire then to insist upon the necessity of largely extending the public analysis possible under the existing Acts of Parliament. I believe that in this respect I have the sympathy of my colleagues, the public analysts of the country. I trust that we shall be able to enlist the sympathy and the support of the public generally. There are few offices perhaps more thankless than that of the Public Analyst—few, if any, public offices the work of which it is more difficult for the public to appreciate, hedged about as it is by all sorts of technical matters incomprehensible to the lay mind; but in spite of misunderstanding and misrepresentation, and of opposition both active and inert; despite the dense atmosphere of ignorance in which we live,

which it is necessary in some degree to pierce and lighten; and with all the narrow sordid interests which have to be overcome, I cannot believe, with some of my friends, that we shall remain unsupported in our endeavours to bring about substantial and permanent improvement. We desire to see an adequate application of the existing law; but not this alone, for an extension of public analysis far wider than is possible under the present law must be fought for and obtained.

In Great Britain the Public Analyst can only deal officially with "foods and drugs." I contend that an extension and amendment of our legal machinery is required to enable him to deal with a large number of articles, the manufacturers and vendors of which at present enjoy a free hand to do with the public as they please. It is not to our credit that the first steps in the direction of such an extension have been taken by other nations, and that we should be compelled to cite them as examples for imitation, and to compare their more comprehensive laws with our own, greatly to the disadvantage of the latter. Such comparisons might here be made, but it is impossible within the limits of this paper to enter fully into a question which presents so wide a field for discussion, and I cannot do more than give such indications as may serve to prove my point.

The term "adulteration," as generally understood, does not adequately describe the moral and legal offences which, for want of a better word, it is convenient and desirable to designate by it. The popular idea is that adulteration means nothing more than the mixing of some extraneous matter with an article of food or with a drug. In the absence of a better, it would be convenient to use the word to apply to all cases where any article whatever, designed for human use, on the ground of possible injuriousness to health and on the ground of fraud, or again, on account of ignorance, *(a)* has had any constituent omitted or removed wholly or in part; *(b)* contains any foreign substance giving it a fictitious value or lowering its real value, by respectively increasing or decreasing its bulk, weight, or strength, or altering its nature or quality; *(c)* is an imitation of, or substitution for, another article; and *(d)* contains any substance which can be certified as likely to be dangerous or injurious to health. It is necessary to distinguish carefully between an article which contains impurities, and an article which has been purposely adulterated. An article of food may be of inferior quality, and it may even be unwholesome, without necessarily having been adulterated, and it may come under the only possible definition that can be applied to it under the existing law: careless manufacture, use of damaged or inferior

materials, non-maturity, commencing decomposition, and so forth, may render a food product unwholesome and inferior; and while, as a consequence of such causes, adulteration may be constituted by the presence of certain specific substances, or by the existence of impurity beyond a certain limit, it is important that clear distinctions should be drawn between inferiority, unwholesome inferiority, and adulteration.

The Public Analyst appointed for a district, in addition to the analyses which he is now empowered to make, should have placed in his hands, officially, the examination of the gas and of the water supplies in his district. As things at present stand, the examination of gas in the metropolis is carried out to an extent far less than is desirable by gas-testers appointed by the County Council, who are far too few in number, and who are paid an absurdly small remuneration. In some places the Medical Officer of Health is supposed to examine the gas. This is a mere figment, and in any case he is under no circumstances the proper officer to be entrusted with this work. In the provinces, as a general rule, the official examination of gas is either not carried out at all, or it is a mere farce. As regards water, the metropolis is flooded with reports, very useful and excellent in their way, upon the water supplied from the mains; but analyses of water from the cisterns of houses—a thing continually required—is again a matter that is shelved or bungled. In the provinces, water analysis, too, is placed, most improperly as a matter of principle, in the hands of the Medical Officer of Health; and at this point I beg to be allowed to say that, in my opinion, Medical Officers of Health should have nothing to do with analysis, except in regard to interpreting the results of professional analysts. The appointment of Medical Officer of Health, further, should never be combined with that of Public Analyst. Even when the medical officer is competent to carry out the work, which (and I say it with all respect) cannot be said to be universally the case, the working of one of the two appointments must suffer, for they have nothing, or hardly anything, in common. They do not require the same kind of training, experience, or personal qualities, and their combination is accordingly liable to lead to abuses of various kinds, such as the farming-out of analytical work to a cheap chemist, or of hygienic work to a cheap doctor.

There are, it is true, questions relating to probable or possible production or propagation of disease, upon which a Public Analyst has obviously no business to express official opinions. If he does so he is not unlikely to commit himself seriously. Local authorities should be guided in their action, in cases where the expert knowledge of three distinct professions is involved,

by competent representatives of those three professions—that is to say they should be guided by the combined advice of the Physician, the Public Analyst and the Engineer; and not by that of any single presumably phenomenal member of any one of these professions, who is supposed, upon more or less unsatisfactory evidence, to be in full possession of the knowledge and experience of the other two.

Patent medicines, the various quack nostrums, hair-dyes, soaps, cosmetics, and the large class of similar articles about which our most imaginative advertisements are concocted, should be made liable to seizure by Inspectors, and examination by Public Analysts; and where, as would be very commonly the case, absolutely poisonous substances or ingredients likely to be injurious to health were found, their vendors should be subjected to severe punishment, and the fullest publicity given to the case. A similar course of action should be adopted with articles of clothing, with reference to the materials of which they purport to be composed and to the dyes which have been placed upon them. The use of certain substances having been prohibited by law, their discovery should be made punishable; this is the only way of dealing with the matter. Poisonous dyes, poisonous paints on articles of decoration, such as wall papers; or upon children's toys, which are frequently loaded with pigments of the most dangerous description, should not be permitted to be used at the sweet will of any manufacturer, as is now the case. I have over and over again found arsenic, for example, in articles that were in daily use, and that in large quantities; for instance: in certain muslins—sold in London by hundreds if not thousands of yards—in children's butterfly nets, in gloves and other articles of dress, and my experience in this respect can be amply confirmed by many of my colleagues. The Committee of the House of Commons, upon whose report the Sale of Food and Drugs Act of 1875 was framed, reported that the public appeared, so far as foods and drugs were concerned, to be cheated rather than poisoned. This is true perhaps about food; it is not true about drugs; and it is not too much to say that as regards numerous articles at present untouched by public analysis the public are poisoned as well as cheated. To take another example: the vendors of the different kinds of rubbish sold under the name of "disinfectants," and with which the uninitiated feebly attempt to combat the spread of disease, should be made amenable to some sort of control. None can be better than their seizure by an Inspector, and their public condemnation by an authorized and responsible officer.

The connection between public analysis and sanitary science

is a very intimate one, although, perhaps, not always very obvious. The adulteration of drugs, for instance, has of course a very direct and evident bearing upon public health; the adulteration of milk with water has again many well-known bearings in this direction; but when the evil is extended over a wider field, as it were, the serious import of adulteration in sanitary science is not, at first sight, so plain. Yet, to prevent the food of a community from being systematically robbed of a part of its nutritive value; to prevent the inhabitants of a country from being provided with clothing, the protective value of which is not what it is expected to be, or which contains materials directly detrimental to health; to prevent, in fact, an insidious kind of competition which may have many ulterior and unexpected ultimate effects upon the health of a people, may justly be regarded as a very important function of a Ministry of Health, if such were brought into being. And while one of the great benefits of the present law and of any extension of it is to be found in the prevention of the under-selling of the honest tradesman by dishonest competitors, these matters will necessarily still be dealt with most conveniently, and, in most instances, appropriately, by sanitary authorities.

An extension of public analysis in the general direction, which I have not been able to do more than indicate, if it is to be of real and full service to the community, must necessarily be carried out with a more intelligent appreciation of the heavy responsibility attaching to the duties of both public analysts and inspectors. Even as it has been, and as it is, the public analysts, by their work, have powerfully influenced for good some of the most important trades. The extension of public analysis ought to mean, and would mean, a far stronger and more widespread control over the trade morality of the country.

Dr. J. W. Tripe (London) said one of the most useful points on which the discussion might turn, not to the exclusion of any other point, was as to the necessity of some alteration in the law regarding the unlimited sale of articles of food and patent medicines containing matters injurious to health. He proposed a vote of thanks to Mr. Cassal for his paper, which was carried with acclamation.

Mr. J. Willis Bund (London) said he would not like the statement Mr. Cassal made as to the magistrates of Worcestershire to go out to the world uncontradicted. As a magistrate of the county, and one who had had a good deal to do with the Executive Committee of the County Magistracy, he felt rather jealous of the honour

of the county. He would not be doing his duty to his fellow magistrates if he did not explain why it was the number of samples taken in the county was so small. The Act was carried out by the police; and they only acted when a purchaser complained to them. The conduct of the Act had raised the question whether they could and ought to act if some one did not complain. The paucity of samples taken was owing to the paucity of complaints. He agreed that there should be larger powers for interference, but as the law now stood they had to find the aggrieved person, who was not easily to be found. When they got a complaint, and then only, were they able to act under the Adulteration Acts. He ventured to think that unless very great care was taken, there would be far fewer samples and prosecutions taken in the future than they had at present. Before the Local Government Act was passed the Quarter Sessions appointed an Analyst who carried out the Act; now, there would be three authorities: the Court of Quarter Sessions, or magistrates who had certain powers with regard to the Act; the Standing Joint Committee, who would give orders to the police; and the County Council, who would appoint the analyst. It was said no man could serve two masters: how much less then could he serve three! It was only one instance out of a great many where the result of the Act would be to divide the responsibility and make the laws less aggressive. If an Act could be framed saying that any person selling any goods and representing them to be what they were not, should be liable to a penalty, the difficulty would be abridged.

Dr. C. R. C. Tichborne (Dublin) said that he felt the objects set forth by the reader were perfectly right and just. At the same time he had hardly attributed enough to the deterrent influences of the Adulteration Acts. It struck him that the analyst had not the power, according to the law, of acting himself. He was merely empowered to carry out analyses. The Act should be improved in this respect. He, the speaker, was analyst in the county of Longford. Action there was always taken by the constabulary. There were periodical fairs for the sale of horses, and booths were erected in the fields in which persons who held licenses were allowed to open. His attention to the sale of whiskey there was directed some years ago by a constabulary officer, who told him that the whiskey was so bad that it was allowed to run away after the cessation of business. The reason of this was it was only made to last one day, and it would not last till the next. When emptied upon the grass at the end of the fair, it left a black stain like ink. The so-called whiskey really consisted of methylated spirits, sulphate of iron—which turned it black after a time—and capsicum. Anything would do for them so that it gave the impression that it was a regiment of soldiers going down their throats. It was largely sold. A raid was made at one of these fairs and thirty samples were taken. In some thirteen of these samples prosecutions were taken. Since this occasion they had frequently made raids, and they only had obtained three prosecutions. In these latter cases it was simply because the whiskey had been diluted and

reduced below the standard of strength. The prosecutions had thus had a very deterrent effect. The adulteration of the present day was much more scientific than it used to be. The adulterations practised during the time of the author of "Death in the Pot," were now quite obsolete. The old practice of colouring pickles with copper was not practised in any respectable house.

Mr. G. J. Symons, F.R.S. (London), did not think that, in the matter of adulterations, we were by any means A 1. He recollected a rule in Paris which seemed an extremely good one. He saw an official notice in a shop window there, stating that the proprietor of it had sold something which, upon being taken to the laboratory of the municipality, proved to be very seriously adulterated; and he was told that a person convicted of such an offence was not merely punished, but compelled by law to place a placard in the front of his house to that effect. The copying of this example would be wonderfully preventive of British tradesmen going wrong in the same direction. Unfortunately English Acts of Parliament did not usually contain such practical preventives. He hoped that if any amendment of the Act was passed a clause would be inserted making it compulsory for the convicted tradesmen to exhibit one of these notices.

Mr. Wetherall (Worcester) said Mr. Cassal had stated the case very well from the standpoint of an analyst. Why did adulteration exist? By far the greater reason was that the public desired a cheap article, whether it was pure or not. That this Congress would be helpful in educating the public taste, and leading them to see that it was to their own interest to buy articles which were absolutely pure, he fully hoped. There were eight persons out of ten who preferred to buy impure mustard: and, if they were supplied, the public taste could alone be blamed. He thought it was unjust and unfair to convict the retailer, unless it could be proved that he had adulterated his goods with the view to gaining increased profits. The bulk of samples taken were had from small shops. It was utterly impossible for the people keeping them to adulterate one tithe of the articles sold; and if they were prosecuted they were saddling the wrong horse thereby. Let them put the penalty on the shoulders of those entitled to bear it.

Mr. Cassal (London), replying on the discussion, said that no valid excuse had been brought forward for the inefficient manner in which the Adulteration Acts had been applied in Worcestershire. It was no excuse to say that a few samples only had been taken for analysis because only a few complaints had been made. To wait until complaints were made before taking any action was practically to reduce the present law to the level of the Act of 1860, which laid upon private purchasers the *onus* of having samples analysed if they thought that they were being supplied with adulterated articles. The general public were helpless in this matter,

and it was absurd to expect people to make "complaints" who were altogether ignorant of what they were being supplied with, and had no means of finding out. The plain duty of the magistrates of Worcestershire, and of authorities elsewhere, was to appoint and pay an inspector or inspectors to carry out the Acts, and it was their business to see that those Acts were carried out thoroughly and efficiently. It was very obvious that a great many local authorities required far clearer notions of their duty to the communities they were elected to serve, in reference to the enforcement of the laws against adulteration, than they seemed to possess at present. Much might be done, if it were possible to bring the pressure of public opinion to bear in the direction, at least, of getting the present laws adequately applied. Mr. Bund's suggestion that inspectors should be empowered to take samples of any articles exposed for sale, so that they might be examined with a view of determining whether the purchaser got what he asked for and had a right to expect, struck him (the speaker) as affording an easy way of extending the present law so as to allow of a much wider application of public analysis. He agreed with Mr. Tichborne that the present Acts exercised a very great deterrent influence. This was shown by the enormous decrease in the percentage of adulteration since 1875. While this was so, he had no doubt, and no person who had any experience in these matters could reasonably entertain a doubt, that some of the worst forms of the old adulterations would again recur if there were any relaxation in the law; and there was very good reason to believe that forms of adulteration which had been practically suppressed in those districts where the law was applied, still existed in those where it was a dead letter. Apart from the punishments inflicted, which as a rule were absurdly insignificant, publicity was a very great deterrent. The French system of placarding the details of an offence upon the shop door of an offender, which had been alluded to by Mr. Symons, had a great effect. Vendors who had been summoned for adulteration were always, and very naturally, most anxious to prevent any publication of the fact by the press. They were sometimes very assiduous in their attentions to the representatives of the press in court. The objection raised by Mr. Wetherall was an old one, and was easily met. The retail vendor had his remedy against the wholesale dealer or the manufacturer; but it was a common thing for the wholesale vendors to pay the fines inflicted upon the retailers. Certain retailers simply afforded so many channels through which the wholesale vendors, or the manufacturers of bad articles, could distribute them at a profit over a wide area. He contended, further, that the desire of the public to buy cheap things was no excuse for adulteration. This, in fact, ought to be self-evident. The objection about mustard was also an old one. It was asserted that the admixture of flour with mustard was necessary for, and was indeed, desired by, the consumer. It was remarkable that if the latter was really so anxious to have his mustard mixed, the vendors did not publish the fact of the admixture far and

wide. They did not do so at any rate when the adulteration amounted to 20 or 25 per cent. It was curious that it should be necessary to point out that mustard mixed with flour was not mustard; but the mustard question was not the most important one. Adulteration should be regarded as a most serious offence, and not as a mild and trumpery one as was so frequently the case.

On "*Some Recent Results obtained in the Practical Treatment of Sewage*," *by* Percy F. Frankland, Ph.D., B.Sc. (Lond.), Assoc. Royal School of Mines, F.C.S., F.I.C.

Although it is not difficult to obtain reports, substantiated by more or less elaborate chemical analyses, on the efficiency of patent processes for the treatment of town-sewage, yet the value of such testimonials is generally but slight, inasmuch as the experiments upon which they are based have usually been made under circumstances of such an exceptional character that similar results are rarely if ever realised in actual practice.

Having recently had occasion to inspect a number of the largest sewage works in the country, in connection with a proposed scheme for the disposal of the sewage of one of our most important towns, it appears to me that the results of this enquiry into the daily practical working of the more important processes now in operation, may not be without interest to those directly or indirectly concerned with the disposal of town-sewage.

The sewage works examined were six in number, and were representative of all the principal methods of treatment now in vogue. For various reasons it will be preferable to refer to the several towns by distinctive letters instead of by their names. In the case of three of the towns the method of treatment was by precipitation only, whilst in the other three the latter was supplemented by application to land.

Treatment by Precipitation only.

Town A.—In the case of this town nine to ten million gallons are treated daily, and the only precipitant used is lime, which is added in the proportion of one ton to 1,000,000 gallons of

sewage. The lime is made into a thin cream, which then mixes with the sewage in the pump-well and becomes thoroughly incorporated with it in the process of pumping. The mixture then flows into a series of twelve depositing tanks, of a total area of 71,270 square feet, or 1·75 acre, and of an average depth of six feet, the cubical contents being 2,500,000 gallons. The sewage has thus to pass a distance of 1200 feet through the tanks, and this passage occupies about two hours. The tanks are divided from each other by walls, over which the sewage flows. As indicating the distribution of the precipitate it should be mentioned that the first four tanks are cleaned out consecutively about every fourth day, the fifth and sixth about every seventh day, whilst the remaining six scarcely ever require cleaning.

From the analyses given below, through the proportion of chlorine it appears that the samples of effluent collected were all derived from somewhat weaker sewage than that represented by the sample of raw sewage. The suspended matter in the effluent sewage, however, may be taken at about two to three parts per 100,000, and of this about one half was organic in nature.

Towns B and C.—These two may be considered together, inasmuch as the method known as "intermittent treatment" with lime alone is practically the same in both. At town C, the daily quantity of sewage dealt with is 10,000,000 gallons. The sewage receives fifteen cwts. of lime per 1,000,000 gallons, the lime being as usual added in the form of cream. The precipitation takes place in a system of no less than thirty tanks, the important distinguishing feature being that a period of perfect rest is given to the sewage in each tank. Each tank has a capacity of 50,000 gallons, the total tank-capacity being 1,500,000 gallons. The method of working consists in filling four tanks simultaneously, this occupies upwards of sixteen minutes; after about twenty minutes complete rest, the liquid is run off through a floating exit-pipe, from which it passes over a weir in a thin layer, and then downward through a filter which is constructed of lumps of coke, to a depth of about two feet, after which it passes upwards through a similar layer of coke. The coke in these filters is changed about every three months. The process of drawing off the clarified liquid from a tank takes about two hours, but it is considered advisable to allow even longer.

The analyses given below show that this complicated system of intermittent precipitation yielded results very similar, but by no means superior, to those obtained by the simpler method of continuous precipitation adopted in the case of town A.

Moreover, the process of filtration through coke, as carried out at these works, appears to deteriorate rather than improve the character of the effluent.

Treatment by Precipitation and Subsequent Application to Land.

In the case of the three other towns visited this compound method of treatment was in operation, but in order to be able to compare the efficiency of the methods of chemical treatment with those adopted in the three towns referred to above, the effluent from the precipitation-tanks, as well as that from the land, was in each case submitted to separate chemical examination.

Town D.—Here the sewage of 50,000 inhabitants, amounting to 2,000,000 gallons daily, is treated with 13 cwts. of quick or one ton of slaked lime and 18 cwts. of sulphate of alumina. The sewage first receives the requisite amount of sulphate of alumina, after which the lime is added, a thorough mixture being effected in a special tank of small dimensions. The treated sewage then flows into eight tanks arranged in parallel series, each tank being 5 ft. 6 in. in depth, and having a capacity of 120,000 gallons is not subdivided by any partitions. Thus, although a given volume of sewage only passes through a single tank, still the total tank-capacity is so large in proportion to the volume of the sewage, that the rate of passage through the tank is extremely slow.

On referring to the analyses it will be seen that this extremely simple arrangement also yields an effluent containing as little suspended matter as that from any of the more complicated systems of tanks already referred to. Two out of the eight tanks are daily completely emptied, and yield 74 tons of wet sludge. It is worthy of notice that at these works a ready sale for the pressed sludge is obtained at the rate of about 1s. a load, and in point of fact, at the time of my visit there was little or no sludge on the premises.

The effluent from this process of chemical treatment then passes on to a plot of land eight acres in extent, and laid out in intermittent filters, underdrained at a depth of 4 to 6 feet. This land yields seven crops of rye-grass annually, and realises from £2 to £3 a week.

The chemical examination of the effluent from this land shows that, whilst the proportion of suspended matter is undiminished, the dissolved organic matter has undergone very considerable reduction. It is evident, however, that the area of land is

insufficient to completely deal with the quantity of sewage applied to it, inasmuch as the effluent is quite free from nitrates.

This town affords a very striking and interesting example of sewage-treatment, both by chemicals and filtration, the method of precipitation being remarkably simple and compact, whilst the area for filtration purposes is exceptionally small.

Town E.—In the case of this town, the principal purification relied upon is the application to land, towards which the chemical treatment is merely a preliminary operation.

The sewage, about a third of a mile before reaching the works, receives an addition of lime to the extent of about 16 cwts. per 1,000,000 gallons. On reaching the works the treated sewage divides into three large tanks arranged in parallel series, and in passing through which precipitation takes place.

Reference to the analytical table will show that the effluent from this single-tank precipitation contained only a small proportion of suspended matter, whilst the organic matter in solution was scarcely reduced at all. The effluent from the tanks is then distributed over the land by way of irrigation, each acre receiving on an average the sewage of 400 or 500 persons. The soil is extremely well suited for the purpose, being gravelly throughout, and is drained to a minimum depth of 4 ft. 6 in. The farm is made to yield a very varied produce; thus—milk is a large and increasing item, a considerable portion of the area is devoted to mangolds, swedes, and Kohl rabi, another large fraction to market garden produce, another to Italian rye-grass, another to cereals, besides a large part laid down as pasture.

A sample of the effluent from the land was collected, and found to be almost free from suspended matter, whilst the organic matter in solution was also very largely reduced. As evidence of the liberal allowance of land given to the purification of the sewage, a very large proportion of nitrates was found in the effluent, which in this respect presented a marked contrast to the conditions existing in the case of town D, where the sewage of about 6,000 persons is applied per acre.

Town F.—In the case of this town the allowance of land for purification is even greater than in that of town E, inasmuch as only the sewage of about 300 or 400 persons is applied per acre.

The method of chemical treatment is varied, sometimes lime and sulphate of alumina being used, whilst at other times, especially in summer, lime and refuse carbon are employed. The lime is added first (about 16 cwts. per 1,000,000 gallons), and then the sulphate of alumina (about 5 to 10 cwts. per

DR. FRANKLAND'S PAPER.—*Results of Analysis expressed in parts per* 100,000.

	Description.	Matters in Solution.							Matters in Suspension.		
		Total Solid Matters.	Organic Carbon.	Organic Nitrogen.	Ammonia.	Nitrogen as Nitrates and Nitrites.	Total Combined Nitrogen.	Chlorine.	Mineral.	Organic.	Total.
	Chemical Treatment only:										
Town A.	Raw Sewage	96·48	4·066	·987	2·30	0	2·881	16·5	17·12	29·40	46·52
„	Effluent *(a)*	64·08	·980	·333	1·20	0	1·321	11·2	·56	·56	1·12
„	„ *(b)*	75·36	1·342	·503	1·30	0	1·574	15·1	1·58	·46	2·04
„	„ *(c)*	88·76	2·000	·444	1·80	0	1·926	13·6	1·88	1·56	3·44
„	Limed Sewage from tank after subsidence in Laboratory	95·50	3·887	1·081	1·30	0	2·152	11·6	0	0	0
Town B.	Effluent	178·78	10·847	2·416	·80	0	3·075	7·9	2·34	1·28	3·62
Town C.	Raw Sewage	51·00	1·280	·181	1·30	0	1·252	10·6	23·56	15·16	38·72
„	Effluent from Settling-tank	45·12	1·629	·311	·52	0	·739	8·2	1·62	·46	2·08
„	„ after passing over Weir	44·56	1·594	·305	·50	0	·717	8·4	1·64	1·86	3·50
„	„ after filtration through Coke	39·72	1·059	·273	·50	0	·685	7·2	3·60	2·98	6·58
	Chemical Treatment combined with Application to Land:										
Town D.	Raw Sewage	75·00	3·253	·501	4·20	0	3·960	9·4	11·88	22·92	34·80
„	Effluent from tanks	75·00	2·208	·360	3·80	0	3·489	8·7	·98	·68	1·66
„	„ land	60·40	·959	·159	1·30	0	1·230	6·2	·96	·78	1·74
Town E.	Raw Sewage	104·20	4·134	·700	3·70	0	3·747	21·0	23·20	28·64	51·84
„	Effluent from tanks	113·32	3·655	·705	2·50	0	2·764	23·8	2·08	1·52	3·60
„	„ land	80·40	·605	·118	·09	1·548	1·740	11·2	·26	·18	·44
Town F.	Raw Sewage, first day	98·60	4·204	·623	3·00	0	3·094	8·3	10·24	11·76	22·00
„	Effluent from tanks (treatment with Lime and Sulphate of Alumina; ¼ hour's rest)	85·36	2·145	·358	2·30	0	2·252	7·2	1·88	2·12	4·00
„	Effluent from land	85·28	·906	·180	·05	·820	1·041	7·0	·22	·36	·58
„	Raw Sewage, second day	82·20	3·371	·563	4·30	0	4·104	7·1	6·56	9·52	16·08
„	Effluent from tanks (treatment with Lime and Carbon; ½ hour's rest)	73·28	1·617	·204	2·50	0	2·263	7·5	2·52	2·48	5·00
„	Effluent from land	77·00	·937	·275	·005	·611	·890	6·9	·40	·14	·54

1,000,000 gallons); the carbon is employed in about the same proportion as the lime.

After thorough mixture taking place during the process of pumping, the treated sewage passes into six tanks arranged in two parallel sets of three. In these tanks a period of perfect rest is given, which varies in duration according to the quantity of sewage coming down. The clarified liquid is drawn off by means of floating arms, and then passes on to the land. The mode of application consists in causing the sewage to flow twice over the surface of the land, as the attempt to filter it by under-draining proved very unsuccessful, in consequence of the heavy nature of the soil.

The principal produce of the farm is Italian rye-grass, which is cut five times annually; there are also smaller plots under oziers, mangel-wurzel, and market garden produce.

Two complete series of samples, taken on two different days, were submitted to analysis. On the first occasion lime and sulphate of alumina, with a quarter-of-an-hour's rest in the tanks, were employed, whilst on the second day lime and carbon were used with half-an-hour's rest in the tanks. The results obtained were essentially similar on both occasions; in neither case was the removal of suspended matter, by precipitation, very satisfactory, whilst a marked reduction in the proportion of dissolved organic matter was effected. In both cases the effluent from the land was almost quite free from suspended matter, and the dissolved organic matter was very greatly reduced.

General Conclusions.

The six examples described above may be taken as fairly typical of the average performance of some of the best managed sewage-works in the country.

The results show that if the only object of the treatment is the production of a fairly clear effluent, this can be satisfactorily attained by a number of processes of chemical precipitation.

As regards the chemicals employed, there would appear to be distinct evidence in favour of the use of sulphate of alumina along with lime, as by this means the dissolved organic matter is generally more reduced than if lime alone be employed. In no case, however, can any very great reduction in the proportion of dissolved organic matter be secured.

As regards the execution of these precipitation processes, the method of subsidence under complete rest, at any rate as at present carried out, appears to have little to recommend it; for although unquestionably correct in theory, it is difficult in

practice to afford rest of sufficient duration for the advantages to come into play; whilst the far greater complexity both of construction and management which this method entails are very much against it. In none of the three towns in which this method was in operation was the effluent remarkable for its freedom from suspended matter.

In practice the greatest success is to be anticipated by employing the maximum capacity in a single tank of moderate depth without partitions. In short, let the whole of the available money be devoted to the acquisition of the largest system of tanks, of the simplest construction and requiring the least attention.

In cases where not only a clear effluent, but also one as free as possible from dissolved organic matter is required, we must resort now, as heretofore, to the application of the sewage to the land. In such cases, however, the sewage should invariably be submitted to a preliminary process of precipitation.

As regards the amount of sewage which can be safely applied to a given area of land, this must depend mainly upon the nature of the soil; but in all cases the guarantee of active oxidation should be demanded in the shape of a marked proportion of nitrates in the effluent.

[*For discussion on this paper see page* 282.]

On "A Suggested Standard for Effluents from Sewage Works," by J. W. Willis-Bund, F.Z.S., Chairman Severn Fishery Board; Vice-Chairman Worcestershire County Council.

It is now generally admitted that by means of well-designed and effective sewage works, it is possible to purify sewage effluents to almost any extent that may be considered desirable; the question of the degree of purity being dependent on the amount of expenditure in respect of the means of purification, as to what the degree of purity should be, doctors disagree. The Rivers' Pollution Commissioners recommended certain standards, which have subsequently been inserted in various of the Bills for the Prevention of River Pollution; but neither Parliament or the public have accepted these standards as the proper test. The prevailing idea seems to be that no specific standard of purity should be required, but that it should vary

in accordance with the requirements of the locality, that a very low standard would be sufficient in the case of towns on such rivers as the Aire, Calder, or Irwell, while on a clear-flowing river a much higher standard should be required. No two authorities are, however, agreed in saying what that standard should be. Admitting as a general principle that the standard should vary according to locality, I venture to suggest that, to fully carry out the principle, the standard should be, that the effluent should be purified to such an extent that no effect will be produced upon the fish that frequent the stream into which the effluent flows. The effect on the fish that are found in each river being the test of purity for each place, it being laid down as a fundamental principle that the effluent should be purified to the extent that it produced no result on the fish.

At first sight this seems a very small matter, and one that most sanitarians would have no difficulty in agreeing with, but when the details of the matter are considered it will be found to give rise to some serious considerations.

The rivers of the country may be divided into those in which members of the *Salmonidæ* are found, and rivers where they are not; curiously enough up to the present time, with one exception, all sewage works have been placed on rivers from which *Salmonidæ* are absent. The case of York, which is now under consideration of the Local Government Board, is, I believe, the first case of sewage works on a salmon river. It therefore forms a new departure, and it is with reference to it that the proposal contained in this paper was originally suggested.

It is well known that for a long time past it has been the fashion to say that the effluent from sewers does no injury to fish or fish life, because fish are often seen feeding at the mouths of sewers. If sewers only discharge a limited quantity of crude sewage in a fresh state into a river, it may be admitted that little if any harm is done, but the admission must be made subject to two important qualifications; (1) that the matter discharged is sewage, *i.e.*, night soil comparatively fresh, and that no large quantities are allowed to accumulate and putrify in the sewer or near its mouth, and (2) secondly, that the class of fish usually found near sewers and drains or near sewage works are what are usually known as coarse or white fish. With the exception that occasionally an old trout may be found at or near the mouth of a sewer, it is the fact that the *Salmonidæ* do not feed at the entrance to sewers, and are not found there.

It has often been urged as a test, proving that the discharge into rivers from sewers or sewage is harmless, that fish may either be found near the sewer, or that if placed in the effluent they will live in it. The fallacy of the argument lies to some

extent in the way the question is stated. Some fish may be found near sewers, some fish may live in the effluent from sewage works; but the deduction made from this, that all fish like sewers and all fish will live in sewage effluents—is a very different proposition.

Speaking broadly, the fish that inhabit the English rivers are divided into two great classes, *Cyprinidæ*, or fish of the Carp family, and *Salmonidæ*, or fish of the Salmon family. The first are resident in fresh water; the latter comprise migratory species. The first are far more tenacious of life than the second, and will live and even thrive under circumstances in which the second would die at once. Curiously enough, sewage experiments have been made almost exclusively on members of the *Cyprinidæ*, and usually on fish that are the hardiest and most difficult to kill of that family; and yet more curiously, the fish usually selected for experiment is a fish not indigenous to British waters, but one of the hardiest of all the *Cyprinidæ*, the gold fish. It is difficult to say in what amount of impurity a gold fish will not live. In this country he is never seen in really pure water; the water in glass bowls and aquaria, in which he usually dwells, are certainly not to be classed as standards of purity. Yet it is on this fish that the experiments of the effect of sewage and impure effluents are usually made; not probably with any dishonest intention, but because the gold fish can be bought more cheaply and more easily than almost any other live fish.

It may at once be said that experiments with gold fish, even if most honestly carried out, are worthless for any fish but gold fish, and as gold fish are not found in most British rivers, such experiments are worthless for British rivers.

If, however, the gold fish are laid aside and some other of the *Cyprinidæ* taken—roach, dace, or chub, the experiments have hardly a greater value. Leaving out of consideration the fact that the fish forming the *Cyprinidæ* are comparatively valueless when contrasted with fish forming the *Salmonidæ*, and that it is unfair to estimate the damage likely to occur to the fish from the damage that will happen to the least valuable sorts. It is equally unfair to take the hardiest and strongest fish to test the effect of a pollution on them, and ignore its effect on the more delicate kinds. The true test is the effect of the effluent on the most delicate fish found in the river, and this will be its effect on the *Salmonidæ*, not on the *Cyprinidæ*. No one with any knowledge of fish life will deny that *Cyprinidæ* are much hardier and will live under much more unfavourable conditions as to water, than the *Salmonidæ*. Carp may be found living in water so thick from impurity that it

could almost be cut with a knife. *Salmonidæ* will only live in water that is practically pure. A practical instance of this is that the keepers of aquaria always select *Cyprinidæ*, and not *Salmonidæ*, for the purpose of stocking aquaria.

As far as I am aware, no data have been published giving the result of reliable experiments on different kinds of fish with the same polluted water. As far as my limited experiments go, I should classify our *Cyprinidæ* in this way: the hardiest are carp and tench, the rest in this order, namely, roach, chub, dace, bleak, gudgeon, minnow. In rivers that contain only *Cyprinidæ*, the test of the effect of an effluent from sewerage works, would be what effect would it produce on the above fish in the reverse order—beginning with a minnow, if minnows are found in the river, and finishing with a carp; not beginning with a carp and finishing with a minnow. It would be necessary to ascertain precisely the different kinds of fish inhabiting each stream, and then the effect on each kind might be ascertained—not merely by ascertaining if they would live in the effluent, an experiment of very small value—but how far it affects the fish as to their breeding, their size, and their food. Hitherto the idea has been does the effluent kill or not; but this is not the question; killing is only one of the ways in which pollution affects fish: their breeding is affected by the deposit on the spawning-beds, their size, from the lack of food or from the unwholesome food they get—their food the destruction of the various forms of life that they feed on. In a stream I am acquainted with, the effect of a pollution from a mine is not to kill the fish, they are as plentiful as ever, but to cause a great decrease in quality, size, and condition; a fact I put down to the destruction of some item of the food supply, or its general decrease.

If injury to fish is taken as the test, and taken in the way I have ventured to point out, it will make a minute study, far more minute than any we have yet had, of the forms of life in our rivers, absolutely essential before any standard of purity can be fixed upon.

Hitherto, the rivers on which sewage works have been erected, have either had no fish at all in them, or have had the hardiest member of the *Cyprinidæ*. In this class of rivers it would be unfair to compel the Local Authorities to give such a standard of purity to the effluent as was not required by the facts of the case; and on any class of rivers it might well be that the Local Authorities should not be asked to create a purer effluent than is necessary for the fish now inhabiting the stream, and should not be bound to regard the fish that might inhabit the stream when it became pure. Conceding this the test as to all rivers would be: (1) for those containing no fish; (2) for those

containing fish, and this last would be subdivided as to rivers containing *Cyprinidæ* and *Salmonidæ*.

I have left the salmon rivers to the last, because in these a new set of considerations quite distinct from those affecting other streams arise. As is well known in salmon rivers, unless the migratory *Salmonidæ* have a free passage to the upper waters from the sea, the rivers are rapidly destroyed as salmon rivers, quite as effectually as if the fish were actually killed. Experience has shown that a river may be very highly polluted, but still salmon will pass up if the pollution is diluted with a large body of water; and as salmon usually only run up in floods, this is the usual state of things. But experience has also shown that if the pollution is concentrated, the salmon will not face it; and although an effluent from sewage works may be such that it will not actually kill salmon, yet it will just as effectually destroy the river if salmon will not pass it, for they will have to spawn in unsuitable places, and so gradually become extinct. This is the great danger that has to be feared from sewage works on salmon streams. The whole of the sewage will be discharged within very narrow limits; and the great question will be whether the effect of that discharge will not prevent salmon ascending the stream. I can call to mind certain chemical works on a tidal river, that discharge, once a week, certain refuse into the river; the effect of the discharge is that the ascending fish at once drop back. The fear is that a similar result will follow from sewage works, not that salmon or fish will be killed outright, but that they will be deterred from passing up to the river to breed.

The test suggested, that the effluent from sewage works should cause no injury to fish, thus opens out far wider considerations than at first sight appear. Hitherto the matter has not received from the hands of experts the consideration that it deserves. It has been thought quite enough to say—fish are not killed. For the future it is to be hoped such a test will not be considered sufficient, and the whole circumstances of the river and locality will be taken into account. I venture to think that some of the societies which are interested in the question of river pollution would be doing most useful work if they prepared a classified list of the rivers of England and Wales, shewing the fish that inhabit them and the standard of purity required for them. Such a classification would be somewhat as follows :—

Class A. Rivers not containing fish.
„ B. Rivers containing coarse fish, *Cyprinidæ* only.
„ C. Rivers containing coarse fish, *Cyprinidæ* and non-migratory *Salmonidæ*.
„ D. Rivers containing migratory *Salmonidæ*.

For each class a minimum standard of purity should be agreed upon, and the Local Government Board, if possible, should be induced not to sanction any scheme for sewage works on such rivers the effluent from which did not come within the agreed standard.

County Councils have now some powers in the matter of river pollution. It would not be asking too much of those bodies to prepare such a classified list of the streams in their districts, and agree on the standard of purity for each class in their district. If this was done, some progress would be made in the question of the prevention of pollution of rivers.

[*This discussion applies to the two preceding papers by* Percy F. Frankland *and* J. W. Willis-Bund.]

Dr. J. W. Tripe (London) said that as Dr. Frankland's paper was on a kindred subject, the discussion of the two papers would be taken together. He thought they had a kindred bearing. He was obliged to Mr. Willis-Bund for bringing forward such a useful and satisfactory test as to the purity of the rivers; and they ought to give Mr. Bund their hearty thanks. This was carried amidst applause.

Mr. W. C. Sillar (Blackheath) pointed out that whereas Dr. Frankland said that he had taken several samples from some of the best managed sewage works in this country, the whole of these samples were from one kind of process only, viz.—that by precipitation by lime. The effluent should be fit to go into the river without detriment to the fish, but this requirement the lime process never answered; besides, whereas the deposit should be preserved in a state fit for agriculture, lime invariably destroyed it. He defied anyone to go to works where lime was the principal ingredient used without being made aware by offensive odours that such was the case.

Mr. J. Stansfield-Brun (Bradford-on-Avon) said he thought the system Dr. Frankland had referred to—intermittent filtration and irrigation combined—was a very good one. He spoke at some length of his experience on the subject at Oldbury, where on ordinary occasions the effluent was clear and free from smell. He could refer Mr. Sillar also to the system at Wolverton, Bucks, which had been referred to by engineers as the most perfect system of quiescent filtration in the country. At Oldbury there were exceptional advantages in the way of precipitation, quantities of chemicals coming from the chemical works, which deodorised the matter and left little expenditure to be incurred by the local authorities in the purchase of lime and other precipitants. Mr. Sillar said that fish would not live in the effluent where lime was used. However, there were fish in the stream into which the effluent ran at Oldbury.

Mr. H. Southall (Ross) said he lived on a salmon river, not far from a town which had sewage works in connection with the Wye. They wanted to be satisfied—those who were likely to be affected—that any scheme adopted would not destroy the fish. It was known that fish flourished at the present time, and on the opposite side of the river to where there were outlets of sewage, in analyses of the water a trace of sewage had been found. They wanted to be certain that matters were not made worse than at present. In constructing works they should consider the surrounding circumstances, and the character of the river the effluent would be discharged into.

Major Lamorock Flower (London) entirely agreed with the eminently practical and reasonable standards of purity which Mr. Willis-Bund proposed. The difficulty hitherto attending the establishment of a standard of purity of sewage effluents had been the different opinions held by chemists. Experience during the last 18 years in the Lee watershed showed that in the interest of fish life an excess of lime should not be used in the treatment of sewage. Wholesale loss of fish has resulted on several occasions from this cause—notably, some years since at Luton, where the authorities used lime and clay (which they had now happily abandoned in favour of disposal on land), and also at Tottenham, where a very small addition of lime was shown at once by the destruction of thousands of fish.

Dr. Percy Frankland said, in reply to Mr. Sillar, that he had only attempted to treat of *some* results obtained in the treatment of sewage. His paper did not profess to be a complete treatise on the subject of sewage purification, but was intended to record and compare results actually being obtained by the ordinary processes in vogue.

On the "Interception of Miasmatic Emanations from the Subsoil of Dwellings," by Charles R. C. Tichborne, LL.D., F.I.C., L.A.H.I., &c.

Centuries ago the Romans had arrived at a knowledge of the requirements of a good dwelling house, which puts us in the year 1889 to the blush, and Vitruvius would have had cause to smile at much of our modern hygiene. One of the points which received their special care was the construction of their basement floors. The barrier between miasma and their domiciliary supply of air food. When a man lays his head upon his pillow to enjoy those precious eight or nine hours of rest, does he, in nine cases out of ten, breathe the natural atmosphere of the

district, wherever that may be. In my opinion he does not. He has simply placed himself under an inverted bell-jar, or a structure of a similar nature, which collects, and before morning is filled with, the volatile sweatings of the surface soil. This soil is distilling (I use the term as being strictly correct) into the building all the contaminations which it has received during the day. But the soil has besides its special poisons, which it generates in its own laboratory.

The old Roman mansions were protected by layers of concrete, and one of these upper layers contained powdered charcoal.

Some little attention has been given, within the last few years, to the subject of basement floors, but chiefly in isolated cases, where scientific men have personally superintended the construction of their own houses. Wherever trouble has been expended it has been attended with the best results. I state this not from hearsay but from personal knowledge.

In approaching upon a scientific basis the subject of the concreting of basement floors, the following question at once presents itself to our mind: What is the actual extent to which cement will prevent the passage of miasmatic, or deleterious vapours. Deleterious vapours may be divided into two distinct classes: 1st, the permanent gaseous poisons, such as sulphuretted hydrogen; 2nd, organisms, such as microbes, bacilli, &c. Where the 1st class ends and the 2nd commences it will require the bacteriologists of the next century to define, and for our purposes it will be as well to consider them as distinct forms of matter. First, then, to consider the question of porosity, or, in other words, how far are these different cements capable of passing gases. This point is roughly but efficiently determined by the following simple experiment, or series of experiments :—

Thin tubes were taken a foot long and $\frac{1}{4}$ of an inch internal diameter. These were carefully plugged with the cements to be tried, an exact inch of each cement being set in the ends of the tubes. Some of these tubes were allowed to stand four months before being used, so as to get perfectly set. The following materials were used as being typical :—No. 1, fine mortar, made by adding one part quicklime to two of sand; No. 2, plaster of Paris, or anhydrous gypsum; No. 3, Roman cement; No. 4, Portland cement; No. 5, hygienic cement.

This last is a cement with which we have obtained some very successful results in Dublin, and many of the tests given further on, prove that it is specially applicable to basement floors. The specimen experimented with, contained about 5 per cent. of carbolate of calcium, naphthaline, &c.

These different tubes were air dried; each tube was then

closed at the end by an indiarubber cap, which could be removed at will. They were then filled with mercury and inverted in a mercurial trough, so that a Toricellian vacuum was formed in each tube. The caps were then removed, and by observing the order in the fall of mercury, the relative porosity could be determined. It stood in the following order:—

		Relative amount of Porosity.
1.	Mortar	100
2.	Plaster of Paris	75
3.	Roman Cement	25
4.	Portland Cement	10
5.	Hygienic Cement	10 or 8

Their relative position as regards porosity could be determined with certainty; but in the second column is an endeavour to give the relative amount of porosity. This last column, although it conveys a very good idea, is only a rough approximation. It was arrived at by performing a number of experiments, and noting the respective times the mercurial column took to fall. Even if elaborate apparatus had been constructed to arrive at these results with great precision, such precise experiment would be of little use, as hardly two samples of similar kinds of cement would agree to a nicety.

The fall of a foot of mercury, in the case of mortar, is called one hundred, because it is the most porous material—in fact the fall in this case is almost instantaneous, and lasts about half a second. It can just be followed with the eye. The Portland cement is extremely slow, the last inch of mercury taking nearly a quarter of an hour.

A series of experiments were then performed with similar tubes, to determine the rate of diffusion of gas through the different materials. These experiments are confirmatory, but yet in a degree are distinct from the previous ones in their bearing. In such experiments we are drawing important inferences as to how layers of these different kinds of materials would influence what has been aptly called the "ground respiration." Any gas that may pass through such septa or layers of cement, will obey Graham's law of diffusion, viz.:—That the rate of diffusion is in inverse ratio to the square-root of their gravity. Hydrogen was the gas selected to try against atmospheric air. The tubes were again capped with indiarubber, and were filled by displacement with hydrogen gas. They were then inverted into a trough of water, and the caps were removed. A partial vacuum was created in each experiment, which raised the level of the water in each tube according to the respective rate at which it allowed the hydrogen to diffuse, which, as it was the lighter gas, passed through more

rapidly than the atmospheric air passed in. It was thus found that the nature of the septum greatly modified the experiment.

The relative heights of the column of water, above the level in the trough, is given according to the time observed.

	1 Min.	3 Mins.	13 Mins.	20 Mins.	30 Mins.
Lime Mortar - -	$\frac{1}{2}$ inch	$\frac{1}{8}$ inch	0 inch	0 inch	0 inch
Plaster of Paris -	$\frac{1}{4}$ „	1 „	$2\frac{1}{4}$ „	$2\frac{1}{16}$ „	0 „
Roman Cement -	$\frac{1}{4}$ „	$1\frac{1}{4}$ „	2 „	$2\frac{9}{16}$ „	1 „
Portland Cement -	$\frac{1}{8}$ „	1 „	$1\frac{5}{8}$ „	$3\frac{1}{4}$ „	$3\frac{1}{4}$ „
Hygienic Cement -	$\frac{1}{4}$ „	$1\frac{1}{4}$ „	$1\frac{1}{16}$ „	$2\frac{1}{16}$ „	$2\frac{1}{8}$ „

It will be observed that lime mortar is hardly worthy of being called a septum, and is practically without any controlling action upon gases—in fact, under such circumstances, it should be viewed merely as a coarse sieve. It could not exert any control over ground respiration. In the case of the cements it is very perfect, but necessarily slow. The practical reading to my mind is that any ground gas would pass through such materials, as the hygienic cement, very slowly, if at all, because the atmosphere being of a lighter density than such gas as sulphuretted hydrogen, or carbonic acid gas, a downward diffusion would take place, or we may put it thus,—that a ground inspiration would be set up, and that atmospheric oxygen would be carried into the surface soil. There would always be a point or layer of the slowly diffusing ground air which would be presented to an excess of oxygen. The atmospheric oxygen would oxidize the noxious organic matter exactly on the same principle as it destroys the pollution of rivers—if we only keep the organic matter in a sufficient state of attenuation.

So far we have merely treated the question of gaseous diffusion, but it is probable that the most important part of the investigation is the action of cements on the germ contamination. Tyndall has pointed out that plaster of Paris, and even a surface of strong sulphuric acid, is incapable of separating germs. In fact the only filter which he found successful was cotton wool. This observation has been thoroughly indorsed and made use of by subsequent workers in bacteriology. Now to determine the action of cements in separating germs, a series of Pasteur's retorts or flasks were filled with sterilized hay-infusion, containing a little Liebig's extract, and were then plugged with different cements. The retorts, contents, and plugs were all sterilized at a temperature of 212 F. for some days. On being closed they were placed in an incubator. In a short time all of these solutions went with the exception of one—the hygienic cement—which is still perfect.* It is also

* 19th September, 1889. Three weeks old.

interesting to observe that the next best flask is the plain Portland cement. There is only one conclusion to arrive at, that the air in passing through this inch of hygienic cement, was perfectly sterilized.*

Asphalte acts as a perfect plug, but I should say that it is objectionable, because if we have every large area cemented by this material, the surface gases will be more or less under pressure, and if so will force their way through any of the numerous cracks and fissures, which must exist in an ordinary house; besides this, it will largely permeate up the walls which we now see are formed of very porous material.

As regards the permanency of the antiseptic action of hygienic cement, I may as well give here the analysis of a sample of concrete made with it and laid down in Gray's Inn Road in 1885. It was taken up in 1889. When it gave on analysis:—

Moisture	3·00
Antiseptic matter of an extractive nature ..	1·96
Carbolic acid	0·14
Granite with cement	94·90
	100·00

When broken it smelt strongly of the antiseptic used.

I believe that these experiments throw considerable light upon the question of atmospheric contamination from the basement of houses, and I have therefore thought it desirable to place them in a concise form before the Sanitary Institute.

Mr. G. J. Symons, F.R.S. (London), said that, as one of the uninstructed public, he should be glad to have some explanation as to the very small diameter of the tubes which had been employed by Dr. Tichborne in process illustrative of his paper; they had a tube only one-quarter of an inch in diameter. He thought if they wanted to test the permeability of anything, the proper course would have been to have had a large area of it. These illustrations rather showed the power of the materials adhering to glass than the power of penetration through the material itself, so large a proportion of the material being in contact with the glass tube.

Mr. W. White, F.S.A. (London), believed wood block flooring was one of the best of floors for basements, because there was no harbouring of dust, black beetles, mice, or vermin of any sort. It

* To construct a perfect floor not only should the ground be cemented, but the foundation walls should be cut off or rendered impervious to the diffusion of gas by being built for some two or three feet with hard glazed fire bricks, and by using hygienic cement in place of mortar.

would not decay if laid on some substance free from moisture. He was the first to introduce it. This was in the West of England. He first set in mortar or cement, but he afterwards found that it was a great mistake to set it in anything that contained moisture, because when the wood came to dry, the joints opened and it became loose.

Mr. H. R. Newton, F.R.I.B.A. (Weybridge), said that it was extremely satisfactory to find that in these tests Portland cement had come out so well; its use was so universal. He thought the results of the experiments and the order of suitability in which the materials had come out was just what they might have expected. So far as they could judge the experiments were very conclusive in the sense of proving the impermeability of the materials.

Dr. J. W. Tripe (London) said he thought that the discussion had been most interesting to Medical Officers of Health. People wanted to know what was the best material to use. These experiments showed that Portland and hygienic cement were about equal. He had always recommended Portland in preference to Roman cement, but the experiments showed a far greater difference between them than he had anticipated. The difference was exceedingly great, so that no one with the facts that had been laid before them should venture to use Roman cement to make concrete floors. The time occupied by experiments was as nearly as possible corresponding with what they might have expected. He did not think that the size of the tubes had resulted in any way to the detriment of the experiment.

Dr. C. R. C. Tichborne (Dublin), in reply, said that the illustrative experiments had been made in the usual way and the customary precautions had been taken. The smaller the scale of the test the more critical the experiment. Cases occurred of poisoning through the consumption of tinned food, and they all knew that mischief was caused sometimes by an air hole the size of a pin's head in the tin, the enclosed food becoming putrified. Now in the experiments detailed in the author's paper, it was true that the air had to pass through a hole a quarter of an inch in circumference, but then in doing so it had to pass through one inch of cement under experiment. In his opinion there was a practical experiment.

On "Meteorology at the Seaside," by Surgeon-Major W. G. Black, F.R.C.S.E., F.R.Met.S.

This communication consisted of a sketch of the conditions of the *weather* which prevailed during the summer month of August, and autumn ones of September and October at places of resort on the English Channel.

The remarks are founded on a series of observations by portable *meteorological instruments* carried in a hand-bag, which were set up and used where practicable at the time and place at the coast. They showed how easily such opportunities could be utilised at any place the *tourist* went to stay at. The best kind of weather for the visitor was of the *continental type*, or anti-cyclonic, with bright skies and sunny days, and when the air and sea kept up their temperature, and ozone was abundant and southerly breezes prevailed, and the seas were calm and brilliant. The *sea-bather* then indulged himself with water over 60° of temperature, and the air felt warm and dry afterwards to dress by; and multitudes on the beaches enjoyed it. Towards the *end of the season* the weather becomes broken into by irritating cyclonettes creeping up, or cyclones dashing through the channel, which create an uncomfortable surf, and cause a rough wind on the beaches and promenades.

These irruptions brought on *gales* with showery weather and cold *winds*, which cooled the air and afterwards the sea, which was also made uncomfortable by waves or surf on the beaches.

Besides, bathing in the sea now became *dangerous*, in consequence of the development of the backwash of the surf creating an undercurrent below sea level on the beach, which causes the drowning every year of numerous inexperienced sea-bathers.

The promenades and piers now get swept by disagreeable, damp winds, and by spray from the surf, and are soon abandoned; on or about the *equinoctial period* of September 26th, the bathing closes on both coasts, the cars and stages are withdrawn, and the beaches are deserted by their visitors. The *inducements* of climate that take people from grimy cities to the coast resorts, are illustrated by these instrumental observations, as consisting in more ozone, more breezes, more showers, more sun and air, and less heat, less calms, less smoke, less miasmata.

The prevalent *exodus* seems fully justified by observation of all considerations, and the *English coasts* of the British channel seem well adapted for health resorts for the citizen; and it will be to the interest of the town dweller that they should be *improved*, and extended as regards appliances and accommodation for these great migrations.

1.—Meteorology at the Seaside. English Channel. Summer Observations.

Having visited a few places on the coasts of the *Channel* during some autumns past, and observed the weather pheno-

mena by ordinary instruments adapted for the traveller's use, the observations of three months are here summarised.

Of the months, *August*, 1886, was spent at Brighton; *September*, 1885, at Hastings; and *October*, 1887, at Havre and Boulogne, so that a fair idea was got of *Channel weather* during the seasons frequented by tourists.

All the observations have been collected together, and the numerical results put down and *summarised*, and averaged for eighty-five days or twelve weeks. During that time there were forty-nine forenoon tides, and thirty-six afternoon tides, and they were noted because they influence the state of both wind and sea.

(1.) *Ozone* was more prevalent in the *morning* observations than in the afternoon by 2·4 to 1·9, and this was probably due to the *S. Westerly gales* in the Channel being most then, and so more wind blew over the papers.

In ordinary settled weather there is generally *more ozone* in the afternoons, as the ordinary *sea-breezes* or winds then get up after mild mornings, and the coasts get warmed by the sun.

(2.) *Evaporation* was found much more than in towns inland, and averaged ·12 inch per diem, and amounted to a total of 9·98 inches for three months. This seems due to more wind and sun on the coast, and freer air than in inland towns.

(3.) There was a total of twenty-seven *rainy* forenoons, and twenty-five rainy afternoons, the former being due to the existence of drizzly mists, which go off as the day progresses.

(4.) The *winds* blew at a very steady rate generally, and were more in force in the morning than in the evening by 2·67 or 1·36 lbs, to 2·52 or 1·20 lbs., owing to gales dying off in the afternoons, leaving calms at sunset, and fine evenings.

(5.) *Cloudy* weather, for like reasons, was found more prevalent in the forenoons by 6·4 to 5·7 in the evenings, also due to the occurrence of the morning's mist and drizzle.

(6.) The *Temperature* of the air in the rooms *inside* averaged 60°·6 in the morning, and 63°·3 in the evenings, as might be conjectured readily by advance of the day's warmth. The same may be said of the temperatures *outside* the house, which were respectively 54°·5 for a.m. and 55°·9 for p.m., all generally low rates for summer and autumn seasons.

(7.) The *wave* amounts of the sea averaged 2·4 in the mornings, and only 1·8 in the evenings, owing to the greater strength, as shown, of the winds in the mornings, and the greater number of tides, then with high water up the beaches.

(8.) The general *Temperature* of *the sea* amounted to 57·1 F., as taken only in the mornings, and before it had been heated

by the sun, but it shows the *great heat* it holds always, as the temperature of the air on the shore at the time only came up to 54°.

(9.) The *specific gravity* of the sea water averaged what might have been expected, 1·025 in the Channel, where fresh rivers enter it, but it rose above this directly ocean seas got in, during storms blowing up it from the S.W. which stirred up the heavier layers from below the surfaces.

2.—Summary of Winds.

The number of times of the *winds* prevailing have been collected and added up, and there were 77 mornings in which there was some wind, and 78 evenings, leaving 8 *calm* mornings and 7 *calm* evenings, which mostly occurred during the fine summer weather in August, 1886, at Brighton.

The most *prevalent* winds in the mornings were S.W., occurring during the stormy weather of September and October on 26 days, and those in the afternoons were also S.W., blowing on the same occasions 24 days.

The *next* in frequency to the morning and evening were N. winds, 12 each, due to *anticyclonic* winds prevailing in August at Brighton, and in October, 1887, at Boulogne, and the next were *westerly winds* following the subsidence of the gales in September and October, 7 days a.m. and 12 days p.m.

Gales of more or less gravity were noted every month. *August* had 2 days' *stormy* weather from the S.W., occurring at the time of the new moon on the 16th at Brighton. *September* had 7 stormy days from the S.W. included in 5 storms, 1 of which occurred about the new moon, September 29th and 30th.

October had 6 stormy days, included in 3 gales, one of which was from the N. *anticyclonic* at Boulogne on October 24-25th, and the other from the S.W. at Folkestone, October 28-29th, *cyclonic* at the time of full moon on the 31st.

There was also a 3 *days' storm* from the S.W. on *November* 1-2-3rd at Folkestone, with rain and heavy seas. Altogether there were 12 *storms*, taking up 18 days, and 4 of these happened about the new and full moon, and 6 at about the quarter phases.

The *most storms* in number 3, and days 6, occurred with *tides up* about noon and midnight, when the seas were more conspicuous on the beaches at high water.

The *most winds* also occurred with forenoon tides 6, and days 9, and the least with afternoon tides 3 for 4 days, when the surf is least, also, in manifestation on the low shores.

3.—Summary of Storms.

The occurrence of *storms* about the change of the *moon* is a popular belief, and there appears to be certainly sufficient coincidence to warrant it, but that the moon itself is the cause may not yet be alleged.

The *storms* happening about the major changes appear more conspicuous on the coasts, as there the *tides* are higher, and the tidal currents stronger, and the waves larger than if the storm occurred at the neap tides, or at the quarter moons, when the water is low on the beaches.

The *gales* of September 5th, 4–5 p.m., 19th, 7 a.m., 27th, 6 a.m., 28th, 7 a.m., at these half periods lasted only *one day*, and were milder in their effects on the sea, because the latter was lower on the beaches.

The *systems* to which these various *storms* belonged need not here be discussed, as they formed part of larger storm areas beyond the Channel, but the majority belonged to the *North Quadrants*, either of cyclonic or anticyclonic forms.

The *Anticyclonic* one of October 24—25, 1887, at Boulogne, consisted of a sharp cold wind blowing from the *N. W.*, *N.*, and *N.E.*, down the coast, with rapid clouds, open sky, brisk waves, and much beach surf, but there was little rain and there were no nimbus clouds, but chiefly cumulus.

The *tides* were—morning, 4.8 a.m., and evening, 4.43 p.m., and the moon was three-quarters full, so that the conditions of heavy gale were not present, but the *force of the wind* got to 5–6 lbs. per square foot by anemometer, or 32–35 miles per hour.

The *Cyclonic* ones all had about the same characters, and beginning S.S.W. with warm air, veered to S.W. and then W.S.W. with cooler air, and finally went to W., when they gradually died off with clear cooler weather.

They are always accompanied with heavy rains and low *nimbus* clouds and dark stratus, and the *waves* raised by them are large, and may be recognised often as having come from the Atlantic up the channel.

The *Channel* seems to act the part of a *funnel* in attracting Atlantic storms to go through it; and there are along it two *dangerous gaps*, at Portland and Weymouth, and the Isle of Wight and Solent, through which the winds beat with great velocity, and raise tempestuous seas in Chesil Bay and Spithead Roads.

4.—Summary of Months.

(*a.*) The month of *August* spent at Brighton was warm and sunny, with thermometer at 63°·7 in the morning, and 67°·1 in the evening, and barometer averaging 29·96 a.m., and 29·92 p.m.

Ozone was of average quantity, 2·2 in a.m. and 2·3 in p.m., and increased with S.W. winds, and decreased with N.E. winds.

Evaporation was high, or at an average of 0·20 inch per diem, shewing that the air was very *dry*, though wafted from the sea itself; showers, however, fell occasionally.

The *winds* were principally from the S.W., though there were some from N. to N.E. to counterbalance them; but their *force* was only moderate from 2·2 in a.m. to 2·0 in p.m., and consequently the *wave* amounts were also small, 2·1 in a.m. to 1·9 in p.m., and there were 3 to 4 calm days.

The *sea* was warm, 62°·2 morning average, and so sea-bathing was indulged in by crowds every day; its *specific gravity* was below good average (1·024), and the air of the beach was also mild and suitable for open-air recreation, 64°·1 in a.m.

(*b.*) *September.*—The weather now begins to be more changeable, being disturbed by *storms*, which leave behind them a damper and colder atmosphere, as if there was a great struggle in the air to get its temperature reduced by little and little.

Notwithstanding the shorter day, the *ozone* at Hastings shews an *increase* morning and evening, owing to the increase in the S.W. or *Channel winds*, from 4 in a.m. to 3.8 in p.m.

Evaporation at Hastings decreased by half, or to 2·31 inches or ·10 inch per diem, to ·91 inch, or 0·07 inch per diem at Havre, owing to increased *cloudiness*, which is now one-third more than in August, and decreased *sun power* in consequence, bringing with it decrease of air and sea temperature by nearly 10°.

The *winds* have now increased from the S. to W. quarter, and decreased from the N., and *calms* have disappeared almost, and the winds have become stronger by 2·3 in a.m. to 2·8 in p.m. (Beaufort scale).

The *barometer* still continued high, but the *air* temperature on the other hand has decreased considerably.

The aspect of the *sea* at Hastings has become altered, as the *waves* have increased in size; their smooth serenity has now disappeared, and the sea *temperature* has decreased very much—to 58° at 6 a.m., whereas the *specific gravity* has increased.

(*c.*) *October.*—The *changeable* weather has now set in, and storms are common every week.

The *ozone* shows a flickering movement, being pretty high during south-westerly weather, but relapsing after these movements are over down to from 1·2 in a.m. to 0·4 in p.m.; and it was often absent at Boulogne.

Evaporation has notably decreased also, and only now comes

to 0·65 inch to 0·67 inch, or 0·06 inch per diem: due to absence of sun power and increase of rain.

Winds have now broken in from the N. to W. quarter, as well as from the S. to W. quarter as before, and have become stronger in force, up to 4·1 in a.m. and 3·2 in p.m.; and *cloudiness* continues as high as in September, or 7·4 in a.m. and 6·4 in p.m., at Boulogne.

The *temperature* of the *air* has now come down to 10° below last month, or to 47°·2 in a.m. and 48° in p.m.; but the *barometer* still keeps well up, or about 30·28 inches a.m. to 30·36 inches p.m. but goes down at the end.

The *sea* has increased in *wave* amount 4·2 in a.m. and 2·5 in p.m. with the winds, and its temperature has gone down to 51°·4 Boulogne, and the *specific gravity*, 1·030, has risen from the uprising of the denser water from below.

5.—Description of Localities.

(*a.*) *Brighton* seems conspicuous by the *dryness* of the air, indicated by the amount of evaporation of 0·20 inch per diem in August. Coincident with the *warmth* of the *air* 63°·7 in a.m. average in the street, and of 64°·1 a.m. on the beach, open to the sun.

The *temperature* of the *sea* was also notably high, 66°·2 in a.m., but it had about the same specific gravity 1·024 as at Hastings.

The *town* looks south, and lies at the bight of the Sussex bay, and hence it gets *focussed* upon it climatic and solar influences from the south, which are reflected again from its white chalky cliffs and hills, called downs.

(*b.*) *Havre*, being a commercial *sea port*, suffers in its salubrity from the fact, and hence there is paucity of *ozone* 1·6 in a.m. and 0·7 in p.m. and diminished evaporation 0·07 inch, and therefore increase of *dampness*, due to harbour and to wet docks.

The *sea*, however, was of *first quality*, being high in temperature for September 59°·4 and of high specific gravity 1·028 for an estuary, and this may be due to its geographical position, being situated on a *promontory* jutting out westerly into the Channel, and hence catching the *sea currents* and breezes conspicuously from the west.

The *air* was *cooler* than at Hastings in September by 55°·7 to 56°·3 in a.m. and 56°·4 to 59°·4 in p.m. averages in the town, and at the shore 54°·5 to 56°· in a.m. also. A range of *hills* at the back of the town shelters the latter from northerly winds, otherwise it might have been as cold as Dieppe; but the

southern slopes are covered with houses and villas, and fully exposed to the sun and air, and hence it has been made a health resort.

(*c.*) *Boulogne* in respect to topographical merits has the same advantage as Havre in having a range of *heights* on the N. protecting the town below on the south from northerly winds, and so it also has been recommended as a *health resort* for shelter from winter winds. On the other side it is like Havre in showing *deficiency* of *ozone* 1·2 in a.m. and 0·4 in p.m., and increase of *dampness*, due to the influence of harbour and to its docks. The low *evaporation* having only been 0·06 in. per diem.

The *sea*, however, is as good as at Havre, being of high temperature for the month of September 51°·4 and of high specific gravity 1·028, and this, as before, in spite of there being a river close at hand to reduce it.

Folkestone.—The *climate* much resembles that of Boulogne, and its topography too is very similar, there is *deficiency* of ozone 2·6 in a.m. and 0·4 in p.m., and increase of *dampness* owing to harbour, and *evaporation* was low, having only been 0·06 in. per diem.

The *sea*, however, is of high quality being warm 50°·1 for October and of high specific gravity 1·030. The temperature of the *air* is much the same.

6.—Sea Bathing.

It will be pertinent to say something about *Sea Bathing* as due to the climatological object of these remarks on the weather, and to the season of the year when this recreative pursuit is adopted. In general terms it may be stated that warmth of the *sea water above* 60° is felt to be comfortable, and below that may become disagreeable to some people, but that anything *above* 50° may be tolerated perfectly by swimmers who enjoy a cool and refreshing plunge in open water.

However, it may be said that it is not the increased coldness of the water that brings the *bathing season* to an end so soon, but it is due to the more rapid increase of *coldness* and *rawness* of the *air* during our British autumns.

Thus at *Brighton* in *August* we have a sea temperature of 60° and air temperature of 64° on the beach of a very comfortable character, but at *Folkestone* in *October* the sea has come down to 50°, and the air to 47° on the beach, both of which are too low to be pleasant to the ordinary bather.

Sea bathing can very well be *carried on till September 26th*, the critical date for the channel sea-bathing seasons on both coasts to end.

As at *Havre*, where the temperature of sea was up to 59°, and the sea air at 54°, but the air was higher still at *Hastings* in the same month at 56°, though that of the sea was lower 58°.

The *temperature of the sea* seems *very stubborn* in giving way to the advent of winter, and retains its initial heat long after that of the air has descended. It is only *forced down* after prolonged bouts of Northerly (W. and E.) winds, which chill its surface and bring cold currents from the North Sea into the English Channel. The *Channel Sea* makes fitful struggles against reduction by the occasionally shooting in of a *warm current* from the Atlantic Ocean during the prevalence of a S.W. gale, which is readily *detected* by the thermometer and by the hydrometer, indicating an increase in the temperature and specific gravity of the water.

This *increase of density* seems due to the mixture of fresh salt water from the open ocean, and not to increase of cold, as the temperatures of sea and air both rise during *S.W.* gales, and this occurs in spite of the *heavy rains* that burst forth then, that would lessen it by mixing it with distilled water from the clouds.

Finally, the *sea succumbs* to the protracted batteries of *arctic currents* and winds, and settles down to a *winter* hibernation of character, disagreeable alike to sailors in ships and residents in sea-side resorts.

It will be observed that the *temperature of the sea* was much *lower* at Folkestone and Boulogne further east than at Havre and Hastings further west, even allowing for *some difference* in periods of season. This would seem to have been due to the former places being situated further *east* than the latter, and so have been first reached and exposed to the *cold currents* from the North sea coming through the straits of Dover.

The *close of the sea-bathing* season takes place about September 26th, or about the equinoctial period, when the temperature of both air and sea drops very rapidly in a few days down to the winter stages.

Proprietors of cabins or boxes and hotel keepers readily recognise the change as if by instinct and withdraw their dressing cars, and begin the displenishing of bedrooms and saloons as the visitors insensibly diminish in numbers.

7.—Sea Waves and Beach Surf.

Attention here may be drawn to the characteristics of the sea on the beaches at health resorts in reference to dangerous *sea-bathing.*

Enumeration has been taken of the *numbers of waves* and

sea surf falling on the beaches per minute, which are found to be generally greater in height and less numerous at high water than at low water.

This seems owing to the *slope* of the beach being steeper about high water mark than at low water, when the tides recede far out to the offing, thus permitting deeper water to be maintained in shore.

These waves or *surf* have been *classed* into four sets, and designated ripple, smooth waves, crested waves, and storm surge, the first two of which are *safe to bathe* in, and the last two are dangerous even to swimmers.

The *ripple* waves number about 18 to 20 per minute, and under 1 foot in height, and the *smooth* waves 12 to 18 per minute, and are under 4 feet in height; but the *crested waves* amount to 8 to 12 per minute, and are about 4 feet 6 inches in height; and the surge rollers come to 4 to 8 per minute, and reach about 6 to 9 feet in height on our coasts.

Another circumstance marks the limits of safe and dangerous sea bathing, and that is the length or extent of the *back water* or wash of the surge on the beach, and this is determined by, or is an expression of, the length of the wave itself outside at sea.

Everyone has experienced the discomfort and embarrassment in getting into deep swimming water by having first to *wade through* several feet of rapids and rolling stones before being able to float comfortably.

Now the wave interval of the *ripple* will be under 20 feet, so that the back-wash will probably be less than 10 feet; that of the *smooth* wave will be under 50 feet, and its back-wash will be under 25 feet, which are safe and comfortable limits for wading.

But, on the other hand, the *crested wave* will have a length of wave of 100 feet and a back-wash of 50 feet, or 16 to 17 yards, and the *storm surge* of 200 feet length of wave and 100 feet length of back-wash about, or 30 to 40 yards, all of which are dangerous amounts. The dangerous nature of this *surf-wash* would seem to depend on the powerful rush of the sea water descending the *slope* of the beach, and not ceasing then at the base of the surf, but extending far beneath it out to sea. The greater the slope of the beach the more *acceleration* will the back-wash gain in its descent from high water to low water, and this increased speed may thus exceed the wave speed on the surface of the water above.

Thus the *smooth* wave will have a speed of 300 to 600 feet per minute, or 3 *to* 6 *miles per hour*, which is just within the limits of swimming power; but when we come to the *crested* wave, and find its speed up to 800 feet per minute, or 9 *miles*

per hour, we may readily see the futility of breasting it by human swimming capability.

We may now then come to perceive the powerful surf nature of the *back wash*, that it may even on steep shores exceed the figures given above of the wave speed, that it may amount to *much more* than six miles an hour in fair weather, or more than nine miles per hour in stormy times under water on dangerous coasts.

In consequence of this hydraulic *acceleration* the back wash will rush out to sea far beyond the tidal limits on the bottom of the shore out into deep water, and will then exhibit its powers and might by *debrading* the mud and silt, and making the sea in the offing *muddy* for a mile or two out from the shore.

This back-wash and under or bottom current on beaches will thus render *recovery of bodies* from drowning very difficult, as they will be borne away by it at the bottom of the sea to re-appear somewhere else where the current has slackened off.

In the same way the *cargoes of ships* wrecked on our stormy coasts will be drawn or sucked out of the holds by the back-wash, and carried off with the deep water, and there sunk if heavy, or be floated off to some more distant part if of lighter material.

In cases of *drowning* accidents the aim of the human rescuer should therefore be to get the person to be *floated* on the surface of the water, so as to get out of the under-wash, and into the *upper current* that is rolling on towards the surf on the beach.

8.—Difference between City and Seaside Climate.

The question may now be endeavoured to be answered, what is the *instrumental difference* between the two climates that makes the citizen fly from his dwelling and office at the end of the season, and take refuge at the seaside.

Preliminarily it may be stated that the weather concerned in human climatology should only be considered as connected with a *zone of atmosphere* of some 40 to 50 feet high, or the mean height of our dwellings and hotels.

Everything of weather observation or opinion beyond and above that, may be relegated to pure or *transcendental meteorology*, which is more or less entirely removed from the influence of the solid ground we live and move about on.

Previous to going to Hastings, eleven days were spent in London in 1885, from September 1st to 11th, when observations were taken in the town, as follows:—barometer 29·46 inches to 30·12 inches; thermometer inside at 63° to 67°, outside from 50° to 64°; evaporation total 0·72 inch, or about 0·06 in. per diem; rainy days seven; ozone total 2·0 or only

0·2 per diem; and winds ranged from S.W. 6 to S.E. 2 round by N. The *seaside climate*, after this at Hastings, showed four times as much ozone, twice as much evaporation, three times fewer wet days; thermometer about the same, but barometer much higher.

In comparing sets of *climatological observations* in the *Meteorological Record* for 1885, Vol. V., for Hastings and London (Old Street) for the month of *August*, it will be seen that much the same characteristics are noted. At Hastings the *thermometer* was higher than in London by 67°·7 to 67°·3, but the minimum thermometer was higher in London by 53°·4 to 52°·0, and the mean thermometer also was higher in London by 60°·3 to 60°·1.

The *humidity* of the air at Hastings was greater than in London by 77 to 71, but the cloud was greater in London by 7·5 to 6·3 than at the sea side.

The number of *Rainy Days* was about the same in each, viz., 12, but there was more rain in Hastings than in London by 1·14 inches to 0·89 inch.

Again, in 1886, much the same results are to be noted in the climatological nature of the observations in Hastings and London in *August*.

The max. *Thermometer* was higher in London by 72°·2 to 62°·5 at Hastings, and the min. thermometer also by 56°·6 to 54°·7, and also the mean thermometer by 64°·4 to 62°·1.

The *humidity* of the air was greater at Hastings by 88 to 78, but the cloudy pall was heavier in London by 9·0 to 6·8 at Hastings.

The number of *Rainy Days* was much the same in each, viz., 11; but the amount that fell was greater in Hastings than in London by 1·51 inches to 0·92 inch.

These contrasted results may point to the idea that the reflected or indigenous *heat of the ground* in London may be more conducive to the suspension of the aqueous vapour in cloud than at Hastings, excluding the effect of smoke. The extra *humidity* of the air at Hastings is evidently coincident with the heavier *rainfall*, not on account of the presence of the sea itself, but rather on account of the coast being the *first land* to receive the rain-laden clouds and breezes from the S.W. and S. before they proceed inland to London. By *changing* our habitat, therefore, from London to Hastings on the coast in August, we get more *ozone* to breathe and more *breeze* to fan us; more *moisture* in the air, more *sunshine* in the sky, and more showers and a cooler and fresher air. And we fly from the stuffy *house heat*, the gloomy haze and *smoke pall*, the dry dusty air, the *fusty calms*, the unwashed *exhalations* of the

streets: all these tend to *vitiate the air* we breathe, render the blood impure, and depress and disarrange the nervous functions, both animal and mental. These statements above detailed are intended to refer solely to the instrumental observations here offered for inspection and consideration, and personally obtained by ordinary portable means.

They also only refer to such items of climate of the localities as would be of interest to the tourist and valetudinarian, but not to the requirements of the invalid or incurable, which are of a different shape and character.

Dr. J. W. Tripe (London) moved a vote of thanks to Surgeon-Major Black for his paper, which contained much interesting information. It was carried with acclamation.

Mr. G. J. Symons, F.R.S. (London), considered the paper an extremely useful one, though from a meteorological point of view it was based on imperfect data; still Dr. Black could not be in more than one place at a time. He had compared the different places from his observations in different years; and for that reason the results were not strictly comparable. However, as they could not have what they desired, they must be contented with what they could get. The conclusions at which the author had arrived were such as those who had experience in the matter would agree with. With regard to Dr. Black's remarks respecting evaporation he feared that they were the results of experiments on a small scale. Experiments were made some years ago with a large number of so-called evaporators, and the results were perfectly awful. The amount of evaporation from small vessels was between two and three times as great in proportion as the evaporation from large vessels. The water in small vessels became heated to a higher degree, in some it would rise to ninety-five degrees, but everybody knew that a pond would not rise to anything like the temperature. The average Dr. Black obtained, one-eighth of an inch per diem, was something like twice as much as the truth. Dr. Black went on to multiply this value, and computed the annual evaporation at about forty inches, but the evaporation was not the same all the year round. During the winter it was much less than in summer. From October to March the evaporation was extremely small, in some months practically nothing, so that the yearly total was probably less than half of the amount stated by Dr. Black.

Mr. Southall lamented the want of simultaneous comparison between the places. He was hardly prepared to accept the statement with regard to the difference in the atmospheres of Hastings and London. He could hardly think that in Hastings, with exposure to south and protection from the north winds, the difference would be ten degrees. The paper was an evidence of unremitting observation.

Surgeon-Major W. G. Black (Edinburgh) said meteorologists might work to obtain results by laboured exactitude, but it was his desire to get and retail to others information about the climate of the different places. He did not pretend to have contributed a scientific paper. The instruments he used were not verified at Kew, nor set up in an observatory. The objection might be raised to some of them that they were of small calibre, but they had to be carried in a hand bag and he used the same instruments throughout. With regard to the evaporation, he could not carry a proper scientific instrument with him, such as one could get in an observatory, but was satisfied with a portable one; and the same instruments being used throughout, the results might be used *comparatively* without great error. The evaporation at sea-side places was greater than he expected. It was in consequence of the amount of wind and sun. He thought the sea was as much a point of the meteorology of the sea-side as the air; and visitors to the sea-side enjoyed it as much as the air. He had made many observations of the waves. He had counted the number per minute, and he had noticed there were two sets of waves, the one set fit to bathe in, and the other unfit. He had also estimated their length and height. The waves came in on the surface of the sea driven by the wind, and having to recede in natural sequence were returned at great force owing to the decline of the beach below. Bathing in the upper waves would be safe, but if a person were caught in the under current he would be sure to be drowned, and carried away like a stone. The retiring waves were highly dangerous.

On "The Smoke Nuisance, under the Alkali Acts," by Herbert Fletcher.

Happy are the people of Worcester in knowing little of the evils of smoke. In the manufacturing districts it is blighting every natural beauty of the country, and rendering the much talked-of necessity for cultivating a sense of beauty in the artizan of the town as much an impossibility as it does the embellishment of either private or public buildings with any work of art an absurdity.

There are two distinct sources of the evil—domestic and manufacturing. That the domestic is of comparatively small importance may be seen on Saturday afternoons and Sundays, when the tall chimneys are almost inoffensive. There are at least half-a-dozen excellent mechanical means for extending the atmosphere of the end of the week to the whole of it, and there

are at least 100 firms in England and Scotland using one or other of these with economy and convenience.

The pecuniary advantages of these machines are considerable, but a probable saving of ten per cent. in the coal bill is not sufficient to procure them a trial. The evil arises chiefly from the use of an inferior quality of fuel. Our only hope is in the law, but the administration of it must be placed in other hands than those in which it now rests.

A paper on the Smoke Nuisance was read to the Congress at its meeting in Bolton, two years ago. To that paper this is supplementary, and intended to shew the result of the movement then just recommencing after many years' repose, and to suggest a way of getting over the almost insurmountable difficulties, which beset interference with powerful people in practices, which, though illegal, have been long tolerated.

Seventeen years had elapsed since the Corporation of Bolton had a Smoke Inspector. Almost his first attempt to perform his duty was the bringing up of six of the most important firms in the town. That first attempt was also his last. The Bench, many of them defaulters themselves, dismissed every case, and efforts at smoke prevention, both mechanical on the part of manufacturers, and legal on the part of the Corporation suffered total collapse. Shortly after the visit of the Institute to Bolton a fresh start was made. The three nuisance Inspectors of the town of 112,000 inhabitants were instructed to proceed against the nuisance under certain limitations. When it amounted to the emission of dense smoke for $2\frac{1}{2}$ minutes or of light smoke for 10 minutes in the half-hour, the offenders were to be served with a legal notice. A copy of these instructions was sent to each steam user, as a hint to reform.

The instructions were accompanied by an important foot-note forbidding the inspectors to encourage the idea that abatement to the degree named would be permanently satisfactory, as the Committee had evidence that steam could be made in any quantity under conditions within the control of all manufacturers without any smoke by day or night, and that the present limits of time were made only to cause the worst offenders to be first dealt with.

With varying success the Corporation asked the Bench to order some dozen firms to abate their nuisance, in all cases being opposed by those firms, except in the one case of the L. & Y. Railway Company, who thanked the Corporation for bringing to their notice their neglect of duty. This was the case of a locomotive engine, standing in a siding, and the Company paid without demur the fine of twenty shillings imposed. Certain members of the Bench could not be persuaded that

black smoke was a nuisance at all; others accepted the statement of the defence, that compliance with the order—already made on their first prosecution—was impracticable; and no confidence could be reposed by the Sanitary Committee in the consistency of the judicial decisions.

In one important case of a large and politically leading firm, the legal adviser of the Corporation thought it necessary for the writer to enter the witness-box to swear that the emission of smoke was in the words of the Act "in sufficient quantity to be a nuisance," and to stand the punishment of the opposing counsel for his interference. At length a curious decision of the Queen's Bench was unearthed, which seemed to require the prosecution to specify the remedy to be applied; and though other firms, seeing the power this would place in the hands of an authority, refused to avail themselves of the point, it led to a change in the form of notice and the insertion of words requiring the provision of smoke consuming apparatus, but specifying no particular make.

This form has not yet stood the test of an action; but should it be objected to as indefinite, the objectors would soon feel the fetters they had made for themselves, on the Corporation ordering them to employ one of the several machines used in the borough, and, in order to make sure of success, to increase the number of their boilers.

These proceedings, as may be imagined, were very unpleasant for the promoter, who could not but feel that friendships of old standing were endangered, and that he was largely regarded (by the smoke-makers) as the greatest nuisance in the town.

Many local authorities have made inquiries, and been to see the examples of smokeless manufactories in Bolton; but these inquiries lead to little more than remonstrances from such authorities with their own offenders against the Public Health Act, and in no case yet have led to such violent proceedings on their part as the successful application for a magisterial order of abatement.

The possession of an old house that lends itself to entertainment, and the absence of any domestic authority therein superior to his own, has enabled the writer to entertain both authorities and societies—social, political, scholastic, and industrial; but the tendency of all such is rather to set the receivers of wages in opposition to the payers of them, and for social progress is to be deprecated.

It is only, however, through some such individual action as this, coupled with the constant effort to popularize the movement among the electors of the municipal or rural authorities, that the law can be set in motion, and it must seem obvious that the

success of so important a sanitary reform should not be left to depend on the chance of individuals being found in every sanitary authority's district to incur the odium of such an initiative.

The remedies for this state of things are numerous, such as the omission of the words in the Public Health Act "in sufficient quantity to be a nuisance," or the taxing of furnaces not constructed to consume their smoke and unprovided with a certificate of having passed a certain test. An increase of penalties from a minimum of £10 doubling, as in the metropolis, on each conviction. But the object of this paper was to suggest a good practicable remedy, which has received the sanction of—indeed was suggested to the writer by—the Chief Inspector under the Alkali Acts, namely the scheduling of manufacturing smoke as one of the vapours to be dealt with by the Inspectors of the Local Government Board.

The Chief Inspector has, during the year, in his annual report dispelled the cherished fallacy of the generation of poisonous gases—Carbonic Oxide—in producing smokeless combustion.

The half-dozen almost perfect apparatuses now in the market can be reproduced rapidly to meet any demand.

No hardship is involved in requiring an expenditure of £100 on a steam boiler capable of driving £40,000 worth of mill plant. If such expense was thought a hardship, the ratepayers would in many cases be willing to assist impecunious boiler owners as a proper public expenditure for the public good.

The action of the chemical inspectors has been fraught with great advantage to the public and the chemical manufacturers themselves, and the placing of the smoke nuisance also in their hands would in a few years entirely alter the character for dirt and discomfort now possessed by the manufacturing districts.

This would not prejudice the action of local authorities, who may become impatient of the action of the central authority; but when it did not stimulate them it would relieve them.

We have laws, yet, defective as they are, interested persons in position of authority will not allow them to be put in force. The Government inspectors should be independent.

Mr. Wilkinson (Derby) said that Mr. Fletcher hit the right nail on the head when he said that the evil was in the administration of the Public Health Act. That was where the screw was loose. He had taken proceedings before the magistrates with the result that the miserable fine of one shilling and costs was imposed for practically stifling the inhabitants of a manufacturing town. There were frequent

cases where the black smoke issued for thirty minutes in the hour, and yet one Justice of the Peace said, what they wanted was more black smoke, not less. In manufacturing towns that was the point which should be hammered at. Then Justices of the Peace, as well as members of Local Sanitary Authorities, required to be educated to see that black smoke was not a necessity, and was positively injurious.

Sir Douglas Galton, K.C.B., F.R.S. (London), said his attention had been directed to this question for a very considerable time, and it was true that so far as manufacturing processes were concerned there was no reason why towns should be injured by black smoke. He was afraid the reason there was so much black smoke was the cause sketched in the paper. He thought there were advantages in making the smoke from the factories come under the care of the Inspector under the Alkali Act, and he thought it would be desirable to call the attention of the Local Government Board to the matter to see whether it might be arranged. There was not the same excuse for the nuisance now that there was in the old days when it was less understood; but now every one had full notice, and every one who had constructed new works had only themselves to blame if the law were strictly enforced to compel the prevention of smoke in factories. It had been clearly proved that smoke was preventable with proper apparatus, but the great fault in many large towns would still remain, that of having smoke emitted from their domestic fires; and until something was done in this respect, either by taxation of chimneys which emitted smoke, or in some other way, he did not see how they were to obtain immunity from the smoke of their domestic fires. In London that was the cause of the greatest amount of smoke. A friend of his who lived twelve miles from London told him that flowers that used to grow in his garden six or eight years ago, were now no longer cultivated owing to the smoke. Even at that distance from London these evils were now become so great, and the population was extending so fast, that he was convinced some strong radical measures must be taken for preventing the emission of smoke from domestic fires just as much as from the manufactories.

LECTURE TO THE CONGRESS

BY

Sir Douglas Galton, K.C.B., D.C.L., LL.D., F.R.S.

Delivered 26th September, 1889.

The object of the Sanitary Institute is to promote Sanitary knowledge in the community; and one of the methods by which it endeavours to effect this is by holding, from time to time, an Annual Congress in some important centre.

It thus affords a focus where those persons, interested in Sanitation in adjacent parts of the country, can assemble and discuss the numerous and important questions which surround the subject in what may be termed its present transition state.

The difficulty in an Address like this is to say anything which is new.

If you read Sir Edwin Chadwick's Report upon the Condition of the Labouring Classes, published in 1842, you will find nearly the same suggestions and proposals which we make now.

You will find, in that report, extracts from previous reports of Sanitarians, dating from the year 1800, inculcating the same doctrines.

The only change that we can now put our hands on is in the fact that the words of the earlier sanitarians fell on more sterile soil, and that the education of all classes is now by degrees fitting the people to take advantage of the advice.

There are so many conditions which bear upon our health; and in discussing the subject there are so many aspects in which it must be considered, that repetition on some points becomes a necessity.

Just consider for one moment how the subject meets us at every turn. It concerns our manner of living, our clothing, our food, our dwellings, our exercise, our work, our pleasures.

It concerns not ourselves only; our proceedings affect more or less seriously our friends and our neighbours.

The registration of the causes of death did not come into operation until 1837, when Dr. Farr entered the office of the Registrar-General of England, then presided over by Mr. Lister.

It is only since that period that data have been collected which have brought sanitation into the range of an exact science, by providing us with facts upon which to base our conclusions.

Leading sanitarians had long pointed out that a certain group of diseases was amenable to the control of preventive measures.

These diseases were small-pox, typhus, enteric fever, scarlatina, measles, whooping cough, diphtheria, cholera, and phthisis; but until accurate data as to the causes of death had been collected, their opinions could not be brought to the test of scientific enquiry.

We are now able to point, with unerring certainty, to the fact that given certain conditions of impure air, impure water, and a soil saturated with filth; sickness and death, from one or other of these preventable diseases, will ensue.

We are, however, even yet far from possessing a satisfactory system of registration.

Our published registration returns tell us that so many deaths occurred in a certain district, but the district almost invariably includes portions which are in a good sanitary condition where the health is comparatively good; whilst in other parts of the same district, where insanitary conditions prevail, the sickness and death-rate may be considerable.

The published average tends to conceal these differences of circumstances.

In order to be in possession of more complete data, we require registration districts more carefully divided according to their several circumstances. It is desirable to show the mortality in urban sanitary districts; it is desirable to trace out more fully the sanitary condition in which sufferers from preventable diseases have been living. We require a registration of disease, and it is hoped that the new Act, under which the local authorities are empowered to enforce compulsory notification of infectious disease in their respective districts will be generally adopted over the whole country.

The sanitarian has long associated dirt with disease; and the diseases above mentioned are all more or less affected by the retention, in near proximity, of emanations resulting from the processes of life in human beings and animals.

Small-pox is one of the most dreadful scourges which can afflict mankind. It spreads with fearful rapidity.

Recent investigations by Medical Officers of the Local Government Board would seem to shew that the emanations from small-pox patients may be carried for long distances through the air; and that the concentration of many small-pox patients in one locality in towns, as in small-pox hospitals, may cause the spread of small-pox amongst the inhabitants around, without any personal contact: and it has, therefore, been proposed, by eminent physiologists, to pass all the air from small-pox wards in towns through fire, in order to destroy the poison.*

Although Jenner made his great discovery long before the close of last century, viz.: that man can be protected against small-pox without himself becoming a source of danger to others, as had been the case with inoculation; it was not until 1840 that the first Vaccination Act was passed; and it was not until many years later that vaccination was made compulsory.

To those who recollect how large was the number of deaths from small-pox, and how dreadful was the disfigurement of those who had recovered from the disease, it is a matter of profound astonishment that the importance of vaccination, which is the only absolute safeguard, can be in any way doubted.

Through vaccination and re-vaccination, small-pox has been almost entirely obliterated as a disease in the German army, and largely in German cities.

But in England we have not been so careful in enforcing either vaccination or re-vaccination; and we have suffered even in recent years from severe small-pox epidemics.

There are some towns which, whilst neglecting vaccination, endeavour to protect themselves against the incidence of small-pox by measures of isolation.

The instance of London will explain my meaning.

London is a city in which efforts are made to enforce vaccination; but there is no central sanitary authority in London, and that, necessarily, leads to some laxity in practice.

There is, however, an authority charged with taking care of sufferers from infectious diseases among the pauper classes, viz.: the Metropolitan Asylums Board.

Under this body every case of small-pox, where the patient cannot be isolated in his own home, is at once removed down

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* In this connection it may be observed that the most effectual method of destroying organisms and their spores or germs, is now ascertained to be by exposing them to superheated steam.

the river by ambulance steamers to hospital ships, situated in an uninhabited part of the Lower Thames; and there can be no doubt that, at the present time, it is largely owing to the rapidity of removal of the patients to a place from whence they cannot spread the disease, that London has been lately so remarkably free from small-pox.

Leicester, on the other hand, unfortunately opposes vaccination; it affords similar evidence of the advantage of careful and rapid isolation of the patients, but Leicester couples with isolation of the patients the isolation of those who have been in contact with them; and also endeavours to maintain an efficient sanitary standard in the population of the town. Yet the presence in Leicester of a large population unprotected by vaccination may some day cause it to be the scene of a bad epidemic.

Typhus Fever, which was a common and very fatal disease at the beginning of the century, is essentially associated with overcrowding and destitution.

It used to be the inhabitant of our jails, under the name of jail fever, which was of so infectious a character that on more than one occasion the judge, the jury, and the bar, have caught the fever from the prisoners in court. The old custom of placing a branch of rue on the desk of the judge at the assizes, arose from the supposition that the scent of rue would afford protection against infection.

Jail fever was frequent in over-crowded barracks and camps, and it was the permanent occupant of our towns and villages in those localities where houses were so densely massed together as to preclude the free movement of air in and about them, and where the dwellings were so overcrowded as to ensure the fouling of the air within them by the concentrated emanations of living bodies.

Typhus is essentially the disease of the pauper and badly housed elements of the community; but wherever it prevails it may be caught by those around, who are within the sphere of its influence.

In speaking of London in 1840, Sir John Simon says: "There were courts and alleys hemmed in on all sides by higher houses, having no possibility of any current of air, and (worst of all) sometimes so constructed back-to-back as to forbid the advantage of double windows or of back doors."

"There could be no through ventilation; and amidst it all there was a dense population of human beings with an atmosphere hardly respirable from its closeness and pollution." "Typhus," he added, "prevails there . . . not as an occasional visitor, but as an habitual pestilence."

Between 1856 and 1887, a sum of over fourteen millions sterling was devoted, by the Metropolitan Board of Works, to measures tending almost exclusively to the destruction of unwholesome house property; and to the opening up of wide thoroughfares and breathing spaces in crowded parts of the metropolis.

This is exclusive of the outlay in the erection of wholesome dwellings to replace unwholesome ones.

This latter work was almost altogether undertaken by bodies and individuals who had no access to the public purse, but whose private expenditure, on new dwellings, cannot have fallen far short of a similar sum.

The result is that where there were formerly 230 deaths annually from typhus, there is now only one death.

Whilst typhus fever was the occupant of jails, camps, and city dwellings, where misery and excessive crowding obtained, enteric fever, on the other hand, occurs alike in the crowded tenements of the poor and in the mansions of the wealthy—to which sewer-air has been laid on by ill-contrived arrangements—as well as in scattered rural districts, where the need for the proper disposal of excreta is not properly recognised.

The remedies required for the prevention of the one disease have little or nothing in common with those for the other; and whilst the removal of the conditions favourable to that form of filth which comes of air laden with the accumulated emanations of a crowded and destitute people has freed our towns of typhus, it is necessary for the prevention of enteric fever so to dispose of the excreta and other organic refuse of populations, as to prevent the possibility of their spreading poison either through water and food consumed or through air breathed.

The next of the preventable diseases to which I will allude, viz., scarlatina, has no such relation to water supply and drainage as have those other preventable diseases, of which typhus and enteric fever are types. During 1851–60, the deaths in England and Wales at all ages from scarlatina amounted to 88 per 100,000 living; in the next decennial period, 1861–70, the rate had risen to 97; but during the ten years, 1871–80, there was a substantial diminution, the rate standing at only 72.

From 1878, when the rate was 75 per 100,000 persons living, it fell, year by year, without interruption, till 1886, when it was in the proportion of only 22 per 100,000 living; but in 1887 the death rate from scarlatina rose to 28 per 100,000 persons living.

Up to a comparatively recent date all the more generally adopted means of prevention of scarlet fever were in one way or another included within such processes as had to do with the

isolation of the sick from the healthy, and the disinfection or destruction of such articles as were known to act as vehicles for the infection. Indeed, Sir Edwin Chadwick has persistently advocated personal cleanliness as a safeguard against the spread of infection from scarlet fever—that is to say washing the body from head to foot daily in tepid water, as a powerful factor of prevention against this disease; and he mentions the case of one of the Nightingale nurses who, during a twenty years' experience of attendance in scarlet fever cases, had not caught the infection, and who attributed her immunity to having washed all over twice a day, to having changed her linen daily, to having kept a current of fresh air always flowing through the room, and to having avoided ever drinking out of the glass used by the patient.

But the saving of life in recent years indicated in the above statistics, has, in the main, been brought about by epidemiological research, which appears to be gradually elucidating some of the methods by which the specific contagion of this disease may be multiplied and is communicated to man.

Stage by stage, we have gradually learned the existence of conditions favouring the spread of the infection which lay beyond the limits of the ordinarily-recognized means of personal inter-communication. And, in the prevention of scarlatina, it is probable that we shall, in the future, have largely to rely on the study of disease in the lower animals; for recent investigations appear to make it certain that the cow suffers from a disease of the nature of scarlatina, which is in some way communicable to man through the milk.

This knowledge carries the necessity of enforcing in our cow-houses and farm-yards those sanitary conditions of cleanliness and purity of air and water, which are essential to health in our own surroundings.

The etiology of diphtheria can scarcely be said to be as yet thoroughly understood, and possibly on that account its connection with the germ theory of disease has been the more readily accepted. It undoubtedly receives great development under those insanitary conditions which are involved in the proximity of decaying organic matter. It is eminently infectious. It operates more frequently in sparsely-populated country districts than it does in densely-inhabited towns.

It is stated to appear more frequently in October than in any other month; to prevail more frequently on clayey than on sandy soils; and especially to have a preferential incidence on families that have shown liability to throat affections.

Cholera is not so constantly with us; it appears at uncertain intervals.

The laws governing the spread of cholera are well-understood by sanitarians. The fact that cholera, like other infectious diseases, is a communicable disorder spreading from a focus of infection, has been long known; and the measures required to check its spread have been carried out for many years.

To quote the words of Sir John Simon, "cholera finds its home in excrement-sodden earth, excrement-reeking air, excrement-tainted water."

Remove these conditions, and you will stop cholera. In 1831 and 1848 there were serious epidemics of cholera in England. In towns where the same insanitary conditions had been allowed to continue, the epidemic attacked the same streets, the same houses, and sometimes the same rooms in both epidemics. The removal of insanitary conditions has prevented cholera from again obtaining a foothold in England, although in 1854 and again in 1866 this disease was epidemic in a less degree.

But it is a disgrace to England that we have allowed India to continue to be a hotbed of cholera for so long.

The whole experience of the sanitary measures which have been taken in India show that the prevalence of cholera can be controlled in that country in the same way in which it has been controlled in England.

At the International Congresses on Hygiene, the European nations have insisted upon maintaining a quarantine against vessels coming from India.

Quarantine is, no doubt, an unnecessary interference with trade, because in the face of good sanitary conditions cholera could not find a footing in the seaports.

The continental nations, however, prefer to retain insanitary conditions in their own seaports, and they therefore resort to quarantine. But when we complain, they point to Calcutta and Bombay as being ports where cholera is endemic, and they say—adopt those sanitary measures in India which you have adopted in England, and by which you have prevented cholera from finding a foothold on your own shores for so many years: protect Calcutta and Bombay against cholera by efficient sanitation, and we will take off the quarantine.

The following figures show that these zymotic diseases, which Dr. Farr has aptly called "filth diseases," have of late years been largely reduced by sanitary means:—

The deaths in England and Wales, from these zymotic diseases per 100,000 persons living, which in 1861-70 were 425, were reduced in 1881-87 to 245, whilst in London the deaths from zymotic disease, which in 1861-70 were 519 per 100,000, were reduced in 1881-87 to 313 per 100,000.

In this recapitulation of preventable diseases, I must not omit Phthisis. The Registrar-General says, that of all the causes of death which have a place in the bills of mortality, Phthisis is the one which carries off the largest number of victims.

In the 33 years between 1848—80, it is stated that 1,702,027 deaths were due to Phthisis. In 1887 the deaths from Phthisis amounted to 44,935, which is about 159 per 100,000 of persons living, and is indeed one-twelfth of the whole deaths for the year.

Phthisis has been defined by a recent French Commission to be "a parasitic disease, virulent, contagious, and transmissible from parent to child, caused by the microbes of Koch, which enter the system either through the alimentary canal in the food, or by the lungs, or the skin."

Dr. Thorne Thorne tells us that it accompanies a damp subsoil: it is largely encouraged by indoor occupation where there is absence of means for renewing the air. It levies its toll as much on the humblest cottage industry as on the highest development of our factory system; and it especially prevails where there is inadequate ventilation in and about dwellings, and in workshops in which the atmosphere contains particles of materials used in manufacturing processes; sedentary employment, and constrained positions preventing the due development of the bodily organs, are held to be important factors in assisting the development of this disease.

The progress of sanitation in the reduction of the level of subsoil water, the prevention of damp in dwellings, and improved ventilation in factories and workshops, appear to have had some effect in diminishing this disease. The number of deaths per 100,000, which in 1851-60 amounted to 268, were reduced in 1871-80 to 212.

This short summary of the conditions which affect these several diseases shows us that sanitation involves many factors.

The great improvement which has taken place in recent years, in the construction of instruments of precision, has enabled researches to be made which are daily opening out to us new views of the causes of disease.

We have learnt that, just as a specific organism causes fermentation in liquors, and manufactures for us alcohol out of sugar; just as others of these minute organisms are continually working to convert dead matter into some other form available to be taken up to promote life; so other organisms are present either as the cause or effect of certain forms of disease in animals and plants.

In speaking of diphtheria, Dr. Thorne Thorne tells us that

under certain conditions of evolution, some of these organisms may temporarily obtain a property by which they become infectious, whilst if deprived of the circumstances which favoured this development, they may again lose their infectiveness in the same way as special characteristics may be developed in higher plant life, and be as easily lost again.

The German physiologist, Koch, and others, have in recent years attributed cholera to the presence of a germ. Dr. Klein, who was sent out to India by the Government to examine the question, does not admit that the evidence of this is complete; and certainly at present we know comparatively little of the modes of operation of these organisms, but our knowledge is daily extending.

Whatever, however, may be the facts as to the operation of these minute organisms, their development would seem to require favouring circumstances. Their numbers would appear to increase with insanitary conditions. For instance, in the pure country air, very few microbes can be found in the atmosphere; whilst near the mouths of sewers or near decaying organic matter, the numbers of microbes and spores of fungi found are sometimes enormous. And recent investigations by Professors Carnelly and Bedson, would appear to show that the numbers of these organisms are largely increased in air which is contaminated by the respiration of closely-packed assemblies, particularly when their members are not cleanly in habits or in dress. But, on the other hand, it would seem that a healthy person may have the power to resist their attacks, and that it is mainly owing to lowered vitality resulting from heredity or engendered by insanitary conditions, or from other causes, that these organisms are enabled to obtain a foothold.

The conferences which have recently taken place at the International Congress of Hygiene in Paris, on phthisis, exhibit the danger against which sanitarians must guard in discussing these new discoveries.

The tendency would seem to be to attach more importance to the germ and to its modes of life than to the means which experience has shewn us will certainly limit its destructive power in human beings.

For instance, the discovery of the cholera germ could not, in any way, alter the nature and application of the general laws of sanitary science, as specially applied to the spread of cholera, or of that group of infectious diseases dependent on filth; although the knowledge which would inevitably follow the identification of a cholera germ, of its nature and mode of spread, of the conditions under which it undergoes alteration by temperature, soil, and season, would unquestionably lead to a more

specific application of means to ends than has hitherto been the case.

Whilst, however, it is essential to adopt all known means of protection against imported diseases, such, for instance, as vaccination in the case of small-pox, as isolation of the invaded individual, and as the destruction of the secretions by chemical agency, the prevention of disease aims at something higher. It aims at placing a healthy population in conditions of air, water, warmth, food, dwelling, and work, most favorable to their development. The vigour of their own life is the best security men have against the invasion of their organisation by low corpuscular forms of life: for such the propagating matters of zymotic diseases may be held to be, and, let me add, in the words of Dr. Farr:—"Vaccinate by all means; but at the same time provide streets, spaces, dwellings, water, drainage. Do not leave the dirt in rookeries, in pits, in dunghills. What are municipal bodies, town councillors, aldermen, mayors, provosts," and we may now add county councils, "good for, if they cannot, by administrative measures, displace rookeries by healthy habitations; supply the people with water and with the means of 'cleanliness,' which stands, proverbially, 'next to Godliness?'"

Whatever may be the facts as to the effects produced by these organisms, we do know that the prevalence and progress of certain diseases can be increased or modified by the surroundings in which a population is placed, and by the conditions under which it lives.

For these reasons, if you wish to guard yourself against these diseases, you cannot avoid benefiting others at the same time.

In that aspect improved sanitation may be said to be unselfish. It compels you to confer those benefits upon others which you are endeavouring to confer upon yourself.

Hence sanitation necessarily means the increased well-being of the people, and especially of the lower classes.

Well-to-do people cannot adopt sanitation for themselves alone. If an epidemic breaks out in a village or a town, however carefully you may guard yourself, however splendid the house in which you live, and however you may strive to shut yourself up in it, you stand a chance of catching the disease.

Epidemics can only be prevented by making the whole population sanitary, and by removing from them all disease causes. That means that they must be in a position of well-being and comfort; you must not allow over-crowding in the houses or cottages near you; you must see that houses and cottages near you have good through ventilation and circula-

tion of air around them; you must see that refuse of every sort is removed away from the inside of every house and cottage, and from their vicinity, before it has had time to decompose and pollute the soil and the air; you must see that each house and cottage is supplied with pure water; you must see that the food is not adulterated or impure, and that the milk is not infected; you must see that the level of the subsoil water is lowered so as to prevent damp, and thus check those diseases which are favoured by damp. But to ensure a healthy population, we require something beyond their material well-being: we require a control over the use of intoxicating drinks, and the cultivation of habits of order, sobriety, cleanliness, and prudence; and, above all, of morality.

The facts which I have mentioned as to the causes of these preventable diseases, show that the material insanitary conditions from which we suffer arise very largely from the emanations which living beings throw out of their own bodies, and hence that one great principle of sanitation is to get rid of refuse matter.

In the case of the air in our dwellings, we throw out from our bodies in breathing impurities into the air; and fresh air is necessary to dilute this refuse, and to assist its conversion into innoxious forms of matter. We therefore prohibit the building of houses back to back; we recommend windows capable of opening in every room—light assists cleanliness, darkness means dirt.

Similarly, if we allow the refuse from our rooms, our kitchens, and our stables, to accumulate in, or in close proximity to our dwellings, the emanations from it poison the air around. We therefore inculcate covered metal boxes to hold the refuse which should daily be removed from them to a locality away from the vicinity of the houses, whether in town or country.

Accumulations of organic matter should never be allowed to remain stored up amidst a town population; they should be removed daily outside the town. In large populations, the most effectual way of preventing such refuse from being injurious is to burn all which cannot be utilized as manure.

In the removal of excreta from houses, the use of cesspits—whatever be the material of which they are constructed, except metal—will infallibly gradually pollute the surrounding soil. Therefore cesspits should never be permitted to exist any more than should manure or ashpits sunk into the ground.

In country districts this class of refuse should be mixed with the soil and used in gardens or fields as rapidly as possible.

There is always liquid refuse to be disposed of, and in your villages and country districts you must so remove this that it

shall not run into the ponds from which the cows who supply you with milk are drinking. You must see that it does not flow into your wells over the surface, or penetrate into them underground. Nor must it pass into your steams and rivers until it has been freed, by some form of land filtration, from the poison which your refuse matter has put into it.

In the drainage system for a town, you must remember that such a system, to be complete, must embrace, not only the sewers and the house connections, but also the paving of your streets and yards.

If you adopt sewers for domestic water separate from your street drains, you yet must make provision for both, and if you form your streets of soft materials which pass into your drains, you will have deposits, which will cause not only interruption to the flow of sewage, but danger to health from the putrefactive gases which they would engender.

Therefore the road and yard surface is an important feature in the drainage arrangements of every town.

Having made your drainage system perfect in your town, you have still to dispose of your sewage in such a manner as not to injure streams or rivers.

This question has been discussed and rediscussed for many years without much material advance having been made in the conclusions arrived at.

It may probably be summed up thus —that the most practical method of dealing with the sewage of inland towns is, after causing the solid parts of the sewage to be deposited, by some form of precipitation, to run the liquid over land covered with growing plants.

I said at the beginning of this address that I could tell you little that was new. And all these suggestions which I have just recapitulated have been made over and over again. You will probably each of you say you know all this; but if so, why is it that the suggested precautions are not invariably taken? Why does so much defective sanitation exist? The fact is, the principles of hygiene—the simple rules of a healthy life—should be inculcated on children from their earliest years; and when the children so educated grow up we may hope, and then only, that preventable diseases will be largely diminished.

As bearing on this question I would here quote a remark made in the Annual Report of the United States' Central Education Commission:—

"It is easy to lay down instructions on paper, but they will be of little value if the desire to apply them at the proper moment be absent. We can only make useful citizens by preparing them from infancy for the duties they are to perform.

From the moment when a child enters school his physical and moral instruction should be pursued rationally and methodically. The child should be at once placed in possession of all his faculties, and they should be developed; his nature should be encouraged, his physical instincts cultivated; his sense of symmetry, harmony, and judgment, and especially his faculty of imagination, should be cultivated; he should be made familiar with the habits of those with whom his life will be spent; he should be taught truth, courtesy, justness, indulgence, and usefulness; he should be inspired with purity, beauty, right conduct, and nobleness of character. Having thus prepared him morally and mentally, let him seek out and create for himself his future career."

You will, perhaps, say, what is the national advantage of sanitation when we see our population daily increasing, and labour so plentiful that, in some trades, low wages result; and why should we, by removing preventable causes of death, assist our population to increase faster.

This argument reminds me of an extract from an essay published in a magazine called *The World* in 1755. The essayist says that "prior to the introduction of small-pox inoculation, London, thanks to the fatal ravages of small-pox, was tolerably roomy; people preferred to stay at home in the provinces rather than come to London and catch the disease. But now, thanks to inoculation, this danger has disappeared, and London is most inconveniently crowded.

"This inconvenience has, in a great measure, been hitherto prevented by the proper number of people who were daily removed by the small-pox in the natural way, one at least in seven dying, to the great ease and convenience of the survivors, whereas, since inoculation has prevailed, all hopes of thinning our people in this way are at an end, not above one in 300 being taken off, to the great incumbrance of society."

This was undoubtedly a strong way of stating the case. But the increase of our population is a very serious question.

The first effective census was taken in the year 1801, and the population of England and Wales then numbered 8,892,536. In 1881 it had nearly trebled, and numbered 25,974,439.

The area of England and Wales amounts to 37,239,351 acres. Thus there are nearly $1\frac{1}{2}$ acre to every inhabitant.

The Registrar General further shows us that whilst during the ten years, 1871–80, the natural increment of the people, *i.e.*, the excess of births over deaths, has been at the rate of 15·09 per cent., the diminution by the excess of emigration over immigration has caused a loss of only 0·73 per cent.; and he states that if the rate of increase which has prevailed during the last

half-century continues, the population will be doubled by the year 1936.

When we consider that in our expanding trade, the matters which we export are things that we cannot eat, and that our imports at the present time represent fully 40 per cent. of the food required for the daily sustentation of the people, and that this food is imported from abroad, it certainly behoves our statesmen to consider seriously in what way the land in this country can be more effectually utilised for producing food than is now the case; and how the vast and sparsely peopled colonies which England possesses may be made more subservient than they now are to promoting the welfare of the empire.

Whilst, however, it is impossible to ignore the vast importance of this question, we must bear in mind that it is essentially our duty and our advantage to see that the capacity of the people for working and for producing the necessaries of life shall not be diminished by sickness or a low condition of living.

We have not yet reached the limit at which the people of this country are unable to obtain employment. Up to the present time at least, improved sanitation has been accompanied by an improved condition of the working classes.

We talk of the vast progress which we have made during the present century, and it is most interesting to contrast the condition of things which existed between 1830 and 1837, with that at the present time.

If you read the report of the Poor-Law Commission of 1842, you will see that, in those days, the number in receipt of parochial relief was large. The people were sickly, they were badly housed, frequently in most wretched cottages; supplied with little water, and that little often bad; the refuse was allowed to accumulate, in and around streets and cottages; employment was scarce, food and clothes were dear.

Now, although the number of the people is double what it was in 1831, employment is plentiful; the people are better housed, better clothed, and better fed.

It is difficult for persons, who were not alive in those days, to realise how completely the steam engine, the railways, and the telegraph, have altered the conditions of life. But if we look forward, we may safely say that, great and numerous as have been the inventions which have changed the face of the world during the last half century, the inventions and changes which the next half century will witness will probably far transcend them in interest and in importance.

Up to the present time employment seems to beget employment, and there is no apparent reason why those conditions should change, for the present at least.

Let us now consider what the removal of the preventable causes of death means.

The following table from the supplement to the 35th Annual Report issued from the General Register Office, shews what were the probabilities of living, of the male population, from age to age, if the deaths from preventable diseases were excluded.

ENGLAND AND WALES.—*Four Orders of Life Tables for Males (calculated from the Facts Recorded during the Ten Years* 1861—70), *showing the effect of the Exclusion of Deaths from* (1) *the Principal Zymotic Diseases;* (2) *Phthisis; on the Probabilities of Living from Age to Age.*

Age x.	Living at Each Age x.			Dying in Each Interval of Age.		
	To Die of All Diseases.	The Principal Zymotic Diseases Excluded.	Phthisis Excluded.	Of All Diseases.	The Principal Zymotic Diseases Excluded.	Phthisis Excluded.
0	510,622	510,622	510,622	142,805	99,272	140,977
5	367,817	411,350	369,645	14,688	7,479	13,997
10	353,129	403,871	355,648	7,788	5,934	6,798
15	345,341	397,937	348,850	10,474	9,533	6,857
20	334,867	388,404	341,993	13,854	13,566	7,725
25	321,013	374,838	334,268	30,258	31,164	18,868
35	290,755	343,674	315,400	36,617	39,107	28,010
45	254,138	304,567	287,390	44,313	48,846	40,798
55	209,825	255,721	246,592	58,981	67,133	63,367
65	150,844	188,588	183,225	73,435	87,442	87,279
75	77,409	101,146	95,946	59,583	76,002	73,695
85	17,826	25,144	22,251	17,037	23,948	21,305
95	789	1,196	946	780	1,187	937
105	9	9	9	9	9	9

The Table may be read thus:—Of 510,622 boys born alive, 321,013 attain the age of 25, of whom 30,258 die in the ten years following.

Exempted from attack by miasmatic diseases, 374,838 would survive to the age of 25, 31,164 dying in the next ten years.

Let us, as an example, apply this Table to the population of Worcestershire, where the number of male births in 1887 was 6,154. Assuming the same rate of incidence of zymotic disease to continue to prevail, as is shown in this Table, the number of these male children who would be alive at the age of 25, that is to say, in 1912, when a labouring man attains his full earning power, there would be about 649 more male persons living, if preventable zymotic diseases were abolished, than is now the case; at the age of 35 there would be 638 more; and at the age of 45 there would be about 608 more males living; and at

the age of 65, that is to say, in 1952, when a man's working power may be assumed to be on the decline, there would, if you abolish preventable diseases, still be about 455 more males alive who had been born in the year 1887, than would be alive assuming the mortality of Worcestershire, both general and zymotic, to be similar to that of England and Wales during the period in question.

The community may thus be assumed to have had the benefit from the capacity for work of these extra persons during the 45 years. The money value of this may be roughly assumed from a calculation of Dr. Farr's, in a paper published in the Statistical Society's Proceedings in 1853, on the equitable taxation of property. He there gives the value of high agricultural wages, and of moderate professional incomes.

The value of the future wages of a labourer, at the age of 20, on good wages, is there stated at £637, and the value of the future income of a professional man, earning the moderate income of £288 a year, is stated to be £5,329 at the age of 25, and £6,038 at the age of 40.

If we assume that one-twentieth of the males were of the class above that of labourers, and that only one-fourth of the labourers earned good wages, the capitalized value of the earnings of the larger number of males who would be kept alive, owing to the abolition of zymotic diseases, out of those born in each year, who would otherwise have died, would be not less than a quarter of a million of money; and this would be repeated annually.*

These figures show that there is a direct money value to the community in preserving the health and extending the duration of healthy life of those who live in the community, because it extends their power of labouring and of adding to the wealth of the community; and, moreover, this money saving far exceeds any outlay which would be necessary to remove sanitary defects existing in the county.

In a diminished death-rate there is also the direct saving from diminished funerals, which has been estimated at an average of £5 a funeral; thus the saving of life arising from absence of death from zymotic diseases in males and females, would amount upon the annual death-rate of Worcestershire to above £5,000 a year. But this does not represent the whole saving. Each death from one of the preventable diseases represents many cases of sickness which do not end in death, but which cause a serious loss to the community. The loss from sickness

* Dr. Farr made a later estimate, in which he put the average *net* value of the whole community, men, women, and children, at £159.

arises partly from the loss of earnings, and, in the younger members of a family, from the expense which the sickness causes, from loss of time and otherwise, to the other members of the family. Thus the real meaning of a diminished death-rate is an increased wage-earning power in the community, as well as the diminution of that waste of power which occurs in individuals from sickness and inability to work, and which is to some extent represented by the money spent, owing to that sickness, upon medical advice, upon hospitals, and upon other forms of charity, instead of upon some reproductive service.

In addition to this money loss, consider the loss of happiness from preventable death and sickness. The child is removed in whom the hopes of the father and mother are centred. The mother is snatched away on whom the bringing up of the children so largely depends. The father dies, whose labour has supported the family in comfort, and whose death leaves them to sink into poverty. In addition to this, individual happiness, and the power of enjoyment, depends on health: without health we cannot exert our full energies, we cannot help our neighbours, we cannot fulfil our own daily duties; yet it is upon these matters that a large part of the real happiness of life depends.

I think that it will be interesting to you to see how the preventable diseases in Worcestershire compare with the total in the whole country. I, therefore, asked my friend, Mr. Mundy, of the General Register Office, to prepare for me tables which exhibit the sanitary condition of the registration districts of Worcestershire, compared with that of England and Wales and London.

Those tables are given on the following page. The information which they afford shews that whilst Worcestershire may be classed as a comparatively healthy county, there still exists, in the county, a large amount of preventable disease, which it is the duty of the various sanitary authorities to fight with and suppress.

The health of a district, as measured by the published death-rate, is made up from the average of a number of details; and whilst in parts of each district there are healthy localities, in other parts there are unhealthy places. It is these unhealthy localities which should be attacked: and no sanitary authority should be satisfied until every portion of the district is equally free from preventable disease.

Average Annual Mortality per 1000 *in the Population,*
Decennia 1851—60; 1861—70; 1871—80; and 1881—87.

Registration District, &c.		Mean Population.	All Causes.	The following principal Zymotic diseases	Small-pox.	Measles.	Scarlet Fever.	Diphtheria.	Whooping Cough.	Fever.	Diarrhœa, Dysentery, and Cholera.
England and Wales.	1851—60	18,996,916	22·17	4·11	0·22	0·41	0·88	0·11	0·50	0·91	1·08
	1861—70	21,389,245	22·42	4·25	0·16	0·44	0·97	0·18	0·53	0·88	1·09
	1871—80	24,343,348	21·27	3·40	0·24	0·38	0·72	0·12	0·51	0·49	0·94
	1881—87	*27,154,444*	*19·22*	*2·45*	*0·06*	*0·44*	*0·38*	*0·15*	*0·45*	*0·25*	*0·72*
London..	1851—60	2,583,112	23·63	5·07	0·28	0·53	0·94	0·08	0·87	0·85	1·52
	1861—70	3,029,125	24·31	5·19	0·28	0·56	1·13	0·18	0·88	0·88	1·28
	1871—80	3,535,372	22·37	3·82	0·44	0·51	0·60	0·12	0·81	0·36	0·98
	1881—87	*4,023,456*	*20·32*	*3·13*	*0·17*	*0·62*	*0·37*	*0·22*	*0·70*	*0·23*	*0·82*
Worcestershire.	1851—60	276,844	20·24	3·24	0·21	0·41	0·61	0·12	0·27	0·76	0·86
	1861—70	315,614	20·09	3·63	0·15	0·33	0·94	0·16	0·33	0·71	1·01
	1871—80	359,643	18·95	2·89	0·19	0·26	0·71	0·15	0·33	0·36	0·89
	1881—87	*401,318*	*17·12*	*2·00*	*0·02*	*0·37*	*0·33*	*0·10*	*0·31*	*0·27*	*0·60*
Stourbridge.	1851—60	63,038	22·76	4·58	0·41	0·75	0·63	0·10	0·34	1·02	1·33
	1861—70	71,055	22·25	4·74	0·31	0·44	1·32	0·11	0·42	0·86	1·28
	1871—80	76,491	21·42	4·12	0·54	0·45	1·13	0·09	0·40	0·50	1·01
	1881—87	*81,725*	*19·11*	*3·01*	*0·03*	*0·57*	*0·71*	*0·07*	*0·55*	*0·32*	*0·77*
Kidderminster.	1851—60	31,612	21·33	3·50	0·15	0·50	0·73	0·10	0·22	1·00	0·80
	1861—70	32,628	20·69	3·88	0·13	0·41	1·12	0·14	0·27	0·76	1·05
	1871—80	37,945	19·25	2·90	0·04	0·35	0·68	0·15	0·32	0·35	1·01
	1881—87	*43,173*	*16·99*	*2·48*	*0·04*	*0·44*	*0·33*	*0·13*	*0·22*	*0·54*	*0·78*
Tenbury.	1851—60	7,207	17·25	1·83	0·03	0·22	0·42	0·24	0·24	0·39	0·29
	1861—70	7,597	18·23	1·86	0·08	0·07	0·51	0·09	0·36	0·54	0·21
	1871—80	7,708	18·24	2·07	0·08	0·22	0·52	0·14	0·26	0·36	0·49
	1881—87	*7,512*	*14·68*	*1·20*	....	*0·13*	*0·13*	*0·11*	*0·27*	*0·19*	*0·37*
*Martley	1851—60	14,455	17·86	2·03	0·03	0·08	0·69	0·14	0·17	0·62	0·30
	1861—70	15,703	17·19	2·42	0·03	0·13	0·77	0·16	0·22	0·58	0·53
	1871—80	16,350	16·55	1·58	0·07	0·17	0·28	0·13	0·18	0·26	0·49
	1881—87	*16,419*	*15·44*	*1·04*	*0·01*	*0·10*	*0·32*	*0·06*	*0·16*	*0·13*	*0·26*
*Worcester.	1851—60	29,323	23·12	3·49	0·22	0·33	0·66	0·03	0·37	0·69	1·19
	1861—70	31,693	24·75	4·87	0·22	0·41	1·27	0·14	0·42	0·86	1·55
	1871—80	32,355	23·13	3·48	0·20	0·39	0·54	0·10	0·26	0·38	1·61
	1881—87	*32,254*	*23·86*	*2·33*	*0·00*	*0·33*	*0·20*	*0·06*	*0·32*	*0·30*	*1·12*
Upton-on-Severn.	1851—60	19,540	20·02	2·29	0·04	0·12	0·48	0·25	0·25	0·64	0·51
	1861—70	22,192	19·62	2·03	0·08	0·16	0·47	0·17	0·16	0·53	0·46
	1871—80	23,305	18·45	1·10	0·04	0·07	0·22	0·15	0·14	0·15	0·33
	1881—87	*23,188*	*18·33*	*0·92*	....	*0·09*	*0·06*	*0·13*	*0·17*	*0·23*	*0·24*
Evesham.	1851—60	14,615	18·75	2·83	0·05	0·49	0·64	0·11	0·31	0·70	0·53
	1861—70	15,195	17·88	2·70	0·02	0·16	0·62	0·18	0·26	0·55	0·91
	1871—80	15,447	17·42	1·89	0·06	0·08	0·34	0·30	0·23	0·34	0·54
	1881—87	*15,157*	*15·49*	*1·39*	....	*0·25*	*0·12*	*0·08*	*0·20*	*0·29*	*0·45*
Pershore	1851—60	13,709	17·49	2·02	0·09	0·18	0·37	0·04	0·20	0·42	0·72
	1861—70	14,004	17·34	2·09	0·06	0·16	0·54	0·19	0·13	0·39	0·62
	1871—80	13,851	16·76	1·80	0·02	0·12	0·48	0·22	0·17	0·20	0·59
	1881—87	*13,376*	*16·78*	*1·32*	....	*0·22*	*0·18*	*0·05*	*0·28*	*0·17*	*0·42*
*Droitwich.	1851—60	18,721	18·14	2·36	0·14	0·21	0·57	0·17	0·18	0·51	0·58
	1861—70	20,866	18·67	3·01	0·12	0·24	0·79	0·10	0·29	0·51	0·96
	1871—80	24,261	17·26	2·10	0·08	0·14	0·48	0·14	0·29	0·28	0·69
	1881—87	*27,385*	*13·91*	*1·38*	*0·03*	*0·21*	*0·27*	*0·10*	*0·17*	*0·25*	*0·35*
Bromsgrove.	1851—60	25,514	20·38	2·96	0·30	0·35	0·67	0·06	0·21	0·64	0·73
	1861—70	27,605	21·17	3·68	0·06	0·47	0·68	0·19	0·34	0·99	0·95
	1871—80	30,458	19·39	3·18	0·11	0·23	0·88	0·14	0·34	0·43	1·05
	1881—87	*32,912*	*17·10*	*2·02*	....	*0·56*	*0·24*	*0·06*	*0·26*	*0·20*	*0·70*
King's Norton.	1851—60	39,110	17·12	3·06	0·18	0·36	0·58	0·19	0·27	0·71	0·77
	1861—70	57,076	16·93	3·44	0·10	0·32	0·83	0·23	0·39	0·59	0·98
	1871—80	81,472	16·51	2·81	0·11	0·18	0·74	0·19	0·42	0·33	0·84
	1881—87	*108,217*	*14·65*	*1·68*	*0·02*	*0·32*	*0·23*	*0·15*	*0·28*	*0·18*	*0·50*

NOTE.—The Rates for 1881–87 are calculated on the assumption that the Rates of increase or decrease of the population in the respective districts that prevailed between 1871 and 1881 had been maintained since 1881. This is in some cases doubtful, but there is no means of making a better estimate.

* The recent alteration of boundaries of the City of Worcester alter some of these figures.

In every locality where we find a death-rate of above 16 per 1,000, we may be sure that there is a margin upon which we can work.

When we consider the enormous advantage to the community, both pecuniarily and morally, of diminished death-rates and diminished sickness; when we consider that this improved condition can be obtained by carefully enforcing laws which already exist as to the fitness of the dwelling, the number permitted to occupy it, the maintenance of cleanliness in it and its surroundings, the intelligent examination of those conditions which may pollute the air, the water, or the soil; and when we consider the importance of protecting the purity of the supplies of food; is it not a matter of astonishment that so little care is taken to obtain skilled officers to perform the duties of supervision, and especially that so little consideration is given to the importance of remunerating them adequately for the knowledge which they have been obliged to acquire in order to fit them for the laborious duties which they have to perform.

The prevention of disease is a different function from the cure of disease; and it is scarcely compatible with the requirements of professional avocations that the persons charged with watching over the prevention of disease should be engaged in private practice.

The Medical Officer of Health ought to give his whole time to his duties. If he is to perform these duties efficiently, he must have devoted many years and much attention to the acquirement of scientific knowledge, and he must have learned how to apply that knowledge to practical sanitation. You cannot obtain these qualifications unless you are willing to remunerate your medical officers adequately, and to give to the position permanence and importance.

Similarly the Sanitary Inspector, or the Inspector of Nuisances, who is the eye and the right hand of the Medical Officer of Health, must have a certain amount of scientific knowledge, combined with much practical experience, if he is to exercise his duties effectively.

The possession of these qualifications should be made a necessary contingency of the appointment of every Sanitary Inspector, and these qualifications can only be obtained provided you adequately remunerate your Sanitary Inspectors.

At the present time, when County Councils have had placed upon them the supervision of the sanitation of counties, it is especially necessary that they should take an enlarged and comprehensive view of the duties so laid upon them.

I have endeavoured to show you that so far as money is

concerned, a diminished death-rate from preventable disease, and diminished sickness, means an actual pecuniary gain to the community; but you should consider also the moral side of the question. The healthy body is the necessary casket for the healthy mind, and in order that the nation may advance in education, in sobriety, in morality, and in all those qualities which go to form the true happiness of the people, you should direct all your efforts to abolish preventable disease, and to carry sanitation into all your towns and villages.

SERMON

By the Very Rev. The Dean of Worcester.

Preached in Worcester Cathedral, September 27th, 1889.

Exodus xx. 12.—"The Land which the Lord thy God giveth thee."

Fair, and rich, and well peopled; nobly governed, and very willing to be governed; the manifold factory of the world, its market, its exchange, and its coinage; the home of a Colonial Empire, and the throne of a score of Indian territories; the freest, the purest, the godliest race on God's earth—this is the land which the Lord thy God hath given *thee*.

Would it not be well to celebrate a yearly Eucharist, and bring each of us his offering, all for this alone? Each of us his offering,—even the use of the gift which God hath given us for our welfare and for His service. For it is a *ten-stringed* harp that our hand is holding, and our prayers are held in a *golden* bowl.

But look again—some of our ten strings are hurt, so our harp cannot give out all its music. Let me take up some of those frayed and broken chords and show you them, here in the Presence of God, here where He helps us to mend them.

I pray you to look at them carefully; you who have come from north and south to the midland to bend over the sorrows of England, and to lay your gifted hand on her leprosy; to you who have sat for four days with the spirit of wisdom and understanding, the spirit of council and of might,—aye, and not without the spirit of the fear of the Lord, fearing for great laws that are broken, fearing for death daily conquering where he might be conquered, and lives blighted which might be both blessed and blessing.

I.—The Chord of the Air.

For a heavy cloud rests day and night over the towns of the land which the Lord our God has given us, an earth-born cloud, not like that sign of God's presence and means of His guiding by which Israel walked of old through the Red Sea to the land which God had given them; but like the other side of that cloud which overshadowed and darkened the chariots of Egypt, and ruined all their glory. To you it is given to lift this cloud, and let in light and gladness, and the seven rays of a blessed sunshine into the streets and lanes of the city, for the saving of fuel and for the brightening of life.

A generation ago a manufacturer of Leeds was saving

15 per cent. by his consumption of smoke, yet the cloud is quite as heavy that hangs this afternoon over Leeds. In Newcastle Lord Armstrong burns the smoke of his blast furnaces, but few follow his lead, or grieve over their pollution of the breath of life.

Individuals then have failed, and the trust of fresh air and refreshing breezes has been committed to your Society, that you may purify public opinion, and that it may purify the public atmosphere.

Nor shall you stop till you have opened the window of heaven to every cottage room, and brought the breeze of the ocean and the breath of the mountain to fan the spark of life in every child of our race.

II.—The Chord of Pure Water.

Worse than the blemish of the air is the darkening of the sweet waters of the land which the Lord our God has given us. Water is a special gift to England—the rains that water the earth, water our pastures with a full cup, a cup of blessing, till our fields are the joy of man and beast; and the emerald that is the rainbow over the Throne of God (Rev. iv., 3,) lends its color to the grass of all our hills and dales.

But no rivers are so black as the streams of our land. "Streams," this is no name for the half liquid mud—black, foul and deadly—that fill the channels of those river beds where I caught trout and grayling in my boyhood.

Our Corporations have tried their hand, but Corporations are partly bounded by their borough limits, and their members have many interests to consider; Government has tried its hand, but in this thing the Crown has only power without knowledge.

And now we come to you, to whom knowledge of the secret things of God's nature is given, and the laws of the Most High are revealed; we come to you, whose kingdom, so far as it is natural and physical, knows no earthly bounds; to you, whose only interest is to give a cup of pure water to the children of the race, and to cleanse the waters that wash us.

Give us back, if you can, we cry, give us back the rivers of England, and the fountains of the land which the Lord our God has given us.

Aye, and let the water be not only clean, but sweet and pleasant. Rome was watered, not only by the pure streams that descend from the Alban hills, but they led the Aqua Marcia into their fountains, that delightful water that tempts you to drink it, the cup which the Roman citizen has chosen for 2,000 years before the vines of his Southern hills, to take their place or to temper their dangerous fire.

III.—The Chord of Pure Earth.

For an enemy is not satisfied with the sickness he has emptied into our air and our water; the Earth which our God blessed as He made it, Mother Earth herself is polluted, and the waters that leave our towns are more deadly than those that reach us; a dangerous fire floats down our deep broad drains, and the streams whose source is in the cesspool and the gutter and the conduit; these waters of death, whose gases are the breath of the grave, whose bed is the very bed of sickness, whose heat is the fire of fever. Heal those waters also, we pray you.

The land is accursed, its smell is not that of a field which the Lord our God has blessed. God gave to the Earth the virtue of sweetening all that it touches, and purifying the foul, and transfiguring our very refuse into fertility; but the salt has lost its savour because we have laden it with a burden that it cannot bear. And yet even now God has provided a remedy for every ill; somewhere in this great treasury of a world He has stored the virtue that may make the bitter water sweet, and the poisoned earth to be "a field of offerings;" it may be that the component parts of this medicine must be brought together from east and west, and gathered only by the hands of the wise, and mixed by men who have hearts as noble as their brains, and dispensed with reverence to Him Whose they are and Whom they serve. If you do not know how to help us, if this thing is still hidden from you, ask Him who has given you the divine desire to bear the infirmities of others, ask Him as *children* and you shall come to us as *men*, for men have constantly learnt things on their knees, that no book knows, and nature has failed to tell them.

So, when your gifts have descended like an angel into the pool, the sick man will take up his bed and walk; the outskirts of the towns, into which all England is gathering, shall be healed of their plague, and we shall rejoice again in the land which the Lord our God has given us; aye, the valleys shall laugh and sing.

There is a legend they love to tell in my own county of a dragon that wasted the fair Chase of Wharncliffe, devoured children, and saddened all the land. So the people cried for help, to God and man they cried, and God sent a hero who slew that dragon, and delivered the people and their homes.

I take it the thing is a myth—*i.e.*, an outward form to hold and give a truth worth having. A plague laid low the inhabitants of that Chase, or its undrained marshes slew their children before their time, till some lord reclaimed the land, or some gifted physician stood between the living and the dead.

Will your Institute be the Hero we want to-day? Will you

go forth with the sword and shield you have forged in your crucible or laboratory, and do our battle with the dragon that devours us?

Indeed, it needs the real quality of the hero, his sense of a mission, his readiness to sacrifice himself for the common good; and you know the hero was a man born of the gods, half his nature descended to him from an immortal and heavenly parent. And so it is to-day. Science is cold, and something of the love of men must warm it. An eye that sees a look of the Cross in each weak and suffering person, as well as an eye that sees unknown virtue in some chemical, or undreamed-of power in some refuse by the wayside.

This is the essential nature of the hero of all times—kinship to God, union with our Lord, a sense that he is working *with* God, *for* God, *to* God; a sense that grows by use, and makes his mind reverend, and his skill sacramental, and his life an offering in union with the offering of Christ.

Therefore you come to your Cathedral as the Alpha and Omega of your Congress; you enfold your work in worship, and your work is part of your Faith.

Let me quote some of your own words that you have spoken this week:—"The sanitarian has long associated dirt with disease." What is this but the underside of the old Christian saying, "Cleanliness is next to Godliness." If one saying be true, the other holds equally good. But two witnesses are better than one, and in their undesigned coincidence the kinship of Religion and Sanitation is traced to a common Father.

Here is another sentence from your address of last night:—"But to ensure a healthy population we require something beyond their material well-being. We require a control over the use of intoxicating drinks, and the cultivation of habits of order, sobriety, cleanliness, and prudence; and, *above all*, *morality*."

Aye, morality is a great law, to which other laws, as those of health, are subject. And yet morality is only a law; it can only command and forbid, and exact its terrible penalty when we rebel. But Christianity is power, enabling us to obey, helping us to fulfil the inexorable law, and finding a remedy when we repent of its breach.

Then shall men rise up and bless you, for you shall have given them both power and cause of blessing.

And you, with the many you have helped, shall often kneel together to praise and worship and give your gifts again to God, in some fair Cathedral, or in the little shrine of each man's own heart, or in the Church of those who have been saved, both in body and soul, in the Holy Land which the Lord our God has yet to give us.

MISTAKES ABOUT HEALTH.

LECTURE TO THE WORKING CLASSES,

By Professor W. H. Corfield, M.A., M.D.,

Saturday, September 28th, 1889.

Professor Corfield said: Mr. Mayor, ladies, and gentlemen, I propose in the short time that is allotted to me to speak to you about mistakes made during our lives concerning our health. A pessimist philosopher has said "Youth is a folly, middle age is a mistake, and old age is a regret." Let us hope that that at any rate is not always true, and let us try by seeing how we may best keep our health, that most valuable possession we have—let us try to prevent that saying from being true in our case.

We will then take shortly the different periods of life, and see the mistakes that are either made for us or that we make for ourselves during those periods. First, there is the period of infancy. Now, the first great danger to a young child is from the external cold, but as a rule mothers are too careful of their young children to expose them too much as babies to the external cold, so I pass over that for the present, though it would be a great danger to infants if they were exposed to it, and I will come back to it in the next stage. After that—after exposure to cold—the great danger to infants is from improper feeding. There is only one food which is fitting for the nurture of an infant—the food provided for it by nature, which contains all the substances that are requisite to nourish a young animal mixed in their proper proportions. That food of course is milk. Instead of milk or milk and water all sorts of things are given as you know to young infants. In the first place a large number of mothers give their young infants tea. It has been shown perfectly clearly by investigations which have been made into the lives of young children in the colliery districts, that the growth of infants and young children is stunted to a most remarkable extent by the practice which their mothers have of giving them tea instead of milk. Another thing, as I daresay many of you know, is that all sorts of preparations and

starches are given to infants very often without any milk; for instance, boiled bread. Boiled bread is a very common thing indeed for mothers to give to young children. Now, until infants begin to cut their teeth, and until—which happens at the same time—until the salivary glands, the glands which secrete saliva, which is the substance in the body that digests starch, begin to act, until that is the case, these young children can no more digest boiled bread than I can digest this pocket-handkerchief. I might mention a great number of other things that are given to young infants instead of their proper food; but they are well known to you, and it is not necessary.

Well, the results of giving to young infants foods that they cannot digest, the results are disorders of the digestive apparatus, sickness, vomitting, diarrhœa and so on, and death—death in a large number of instances.

The disease which carries off more young infants than any other, more than zymotics or acute fevers, is the summer diarrhœa of infancy, and one of the most important causes of it is unquestionably improper feeding, feeding with articles not containing milk, with articles that are not milk, also, when milk or water is used as food, feeding with unclean feeding appliances. These are the causes of the diseases that cause the deaths of the greatest number of infants. I was going to say there is a still worse result. Perhaps you will say there cannot be any worse result. But there is a disease commonly known on the Continent as the English disease, "a disease which is known to most of our large towns, the disease called rickets." Now I have the great authority of Sir William Jenner, one of the greatest authorities on children's diseases that can possibly be quoted, for saying that rickets is almost always caused, that the chief cause is improper feeding, and that the chief cause of improper feeding is ignorance, and that if mothers knew that it was not possible for their infants to digest such things as they gave them there would be no more rickets.

Now, I must not pass over infancy without mentioning one thing. Perhaps you do not all agree about it, though I hope to-night you will all agree about it. There is a certain class of diseases which are especially and peculiarly the diseases of infants, or young children and infants; those are the majority of communicable fevers which are diseases, and if a person has once he seldom has again during the rest of his life. Now, unquestionably, the most severe, the most fatal, the most horrible of these is small-pox. We have a precaution of preventing people taking small-pox during the rest of their lives, and that precaution is vaccination during infancy: that is a precaution which is compulsory by the law of the land, but

whether it were compulsory or not, I should not be doing my duty if I did not say it, one of the mistakes which some people make is not to have their children vaccinated before they are three months old. Now, we pass on from infancy to childhood. In childhood the great danger to life and health is the danger I mentioned under infancy — the danger from external cold. Now, why is this? Children we know have quick circulations; they breathe very fast, they manufacture a great deal of heat; they are, so to speak, very hot-blooded creatures, and they ought not to suffer, you think, from external cold. Why do they suffer from the external cold? Simply because they are small; because the smaller the body is, the larger is its surface in proportion to its bulk or contents. You can make this out for yourselves. If you calculate the difference between the surface of a cube, the edge of which is an inch, and its contents, and the surface of a cube, the edge of which is ten inches, and its contents, you will find that the surface of the small cube is ten times larger in relation to its contents than the surface of the large cube in relation to its contents. You may prove the same thing with a sphere, and what is true of a cube and a sphere is true of a child.

It is from the external surface of our bodies that we lose heat, and the child having a much larger surface in proportion to its bulk than the adult has, loses heat from its large surface faster than it can replace it, so the great danger to young children is from external cold. What are the mistakes made in connection with this you will see at once. When we go out of doors, whether in summer or winter we go out clothed from head to foot. There is not a particle of our body that is not covered except our faces and a small part of our heads, and a part of our necks, and perhaps our hands. But how do we send these little children out? although their great danger is from the external cold they are sent out with bare neck, bare arms, and bare legs. It is a most monstrous thing, and the health of thousands of children and the lives of thousands also are sacrificed to the fact that they are sent out in all weathers, whether summer or winter, but particularly in winter with bare arms and bare legs to walk about. Children ought to be clothed always from head to foot, whether in summer or winter. In the winter they ought to be well clothed, and in the summer lightly clothed, and the parents who send their children out partially unclothed would be much more sensible if they went about in the same way themselves instead.

Now children require I need hardly tell you, plenty of food. Hippocrates said "children do not well support a fast," and though it is a long time since he said it we see no reason to correct it.

Children require to be fed frequently and to have plenty of food. They require plenty of sleep because they have to grow. It is a great mistake to worry children to prevent them having the sleep they want. It is during rest, during sleep, that we adults repair our tissues. During work we waste our tissues, during sleep we repair them. Now a child has not got merely to repair his tissues. His tissues have got to become larger, and so he requires more rest and sleep because this is the time when this work is being done. Then children require plenty of change of employment. They require to be a short time at one thing and then a short time at another. I do not care whether the employment is play or work they ought not to be kept too long at one time at the same thing, because their attention becomes strained and tired until they do not care about anything. Many mistakes are made about this, both about enjoyments and still more as regards work. It is a great mistake in schools to keep children too long together at the same task or too long together at any task.

We come next to the third period of life—youth. Youth, we are told by the pessimist philosopher, is "a folly." Well, now, we do not expect youths to be wise men; they would be great prigs if they were. But still, though a certain amount of folly may be excusable, we do not want too much of it. Now, in youth most of our habits are formed; of course they are formed to a certain extent in the periods gone by; but habits are formed and become part of our individuality in youth, and so it is of the greatest possible importance that the habits that are formed should be good ones.

Well, now I will mention what I suppose are the most important of all habits first, though on this point we may very likely have differences of opinion. One of our most eminent judges, who thought he should like to find out how to live as long as possible, made a practice of putting a series of questions on habits to every aged witness who came before him, and he found that these aged people differed largely in their habits, except in one particular. Some of them drank spirits, and some of them did not; some smoked tobacco, some of them in excess, and others did not; some drank tea for their breakfast and others coffee, and so on in other habits; but there was one point they all agreed about, *they were all early risers.* Now, early rising means another thing: it means early going to bed. I defy anybody to be an early riser by habit if he does not also go to bed early; and that "early to bed, early to rise," which it is said "makes a man healthy, wealthy, and wise," is the best habit shown by the enquiries of that learned judge. I mention the first, and I see from your applause that no words of mine

are needed to recommend it to you. What about other habits that are learned in youth?

Well, the worst of all habits learned in youth is the habit of drinking alcoholic liquors in anything like excess, in anything but in great moderation. That is a habit which once acquired is difficult to break, and it is a habit which is got chiefly in two ways. It is not got by drinking wine or beer at meal-times. It is got in the first place by drinking spirits and water at night. This is what men call having a nightcap. That means that when the stomach is empty or nearly empty you take into it a mixture of alcohol and water, and not merely alcohol and water, but alcohol and water containing a much more powerful substance than alcohol does—namely, the essential oil of the whiskey or other spirits which you take. That is a most diffusible fluid, and when you take it into your stomach empty or nearly empty it has its own action on the stomach first and then passes direct into the blood. First it alters the stomach, so that the stomach of the drinker, when examined by experienced anatomists after death is known perfectly well. It is a different kind of thing to the stomach of a healthy man. It is diseased; again this fluid acts directly upon the liver, and produces in the liver a disease which is perfectly characteristic. The liver of a drunkard is as different from the liver of an ordinary individual as a tumbler is from a tea cup and more different.

That this is the case is perfectly obvious, and you will agree with me, and it is perfectly clear that it is so, when I tell you that the diseased liver so characteristic of the drinker and produced by alcohol is known in various countries by the name of the drink. In England it is called "the gin-drinker's liver," in France the "absinthe drinker's liver," and so on in other countries; so that you see a perfectly well recognised alteration in a most important organ of the body (the largest gland in the body) is produced by drinking spirits, and especially by drinking spirits at night-time.

The other way in which spirit drinking is mischievous is in what is called taking "nips"—that is to say, taking small quantities of raw spirit of any kind at all times in the day, not at meal-times. People do not do it at meal-times when it would not do them so much harm, but they do it halfway between meals, when the stomach is empty or nearly empty. That is the other mischievous way in which spirits are drunk, and the result of that is sometimes a good deal more mischievous—it is always more mischievous than the person who drinks expects, but sometimes the effect is a good deal more sudden than he expects. I have known several instances of persons who have drunk a strong dose of some immature whiskey—I say whiskey

because that is most used, the same result might follow from the use of other kinds of raw spirits—I have known cases where a man after a dose of raw whiskey between meal-times has felt a sudden pain in the pit of his stomach as if he had taken a dose of arsenic or antimony, and has fallen prostrate and died in a few minutes. That is direct poisoning from the alcohol, or whatever is contained in the raw whiskey.

Youths should be taught, if they drink alcoholic liquors at all to drink them in the greatest moderation, and to drink them only at meal times. You know some people sign a pledge that they will not take any alcoholic liquors at all. I will not say a word for or against that plan. There are plenty of people who will not do that. If those persons would take a pledge to themselves—whether they sign anything or not is immaterial—and carry it out, not to drink except at meal times, an enormous deal of good would be done.

A very important habit to acquire is that of eating slowly so as to give time for the efficient mastication of the food; people who expect their stomachs to do the work that ought to be done in their mouths must not be surprised if they suffer from indigestion and from all the consequences of it.

Now with regard to smoking I have very little to say. Whatever good smoking may be, later in life, in middle age and old age, all sanitarians agree that smoking is pernicious to growing youths. I have never heard anyone who has attempted to deny that, so I will pass on, merely saying that smoking is a habit not only quite unnecessary for youths to indulge in, but pernicious to growing youths, and therefore they should be discouraged in every possible way from commencing it.

I must not forget to mention to you that cases of small-pox become more frequent during youth even among persons who have been vaccinated in infancy, the effect of infantile vaccination apparently passing away to a great extent at puberty. It is therefore necessary that youths should be re-vaccinated, an operation which provides a far greater security against small-pox than does a previous attack of the disease itself.

We come next then to manhood. Manhood is, as we all know, the time of marriage. I am told that mistakes are sometimes made at this period of life. I am not referring to the mistakes you are thinking about. The mistakes I refer to are of a very different kind. We know there are certain diseases that are called hereditary diseases—diseases which run in families is another way of saying it. We have all heard of families that are called consumptive families. Unfortunately in this climate of ours, where consumption is one of the most fatal of all diseases, and the most fatal in one

sense, killing more than half as many people as all the zymotic fevers put together, consumptive families are not uncommon. We have heard also of nervous families, and these furnish an unusual number of inmates to our lunatic asylums. When we speak of diseases running in families we mean there are certain diseases the tendency of which is hereditary—diseases which descend from father to son, from grandfather to grandson, from mother to daughter, which in fact somehow or other descend from generation to generation. You may ask what has this to do with marriage? It has this: that hereditary diseases are increased in their virulence, and are spread as it were by the marriage of persons belonging to families in whom the same diseases are hereditary. If a person belonging to a consumptive family marries a person belonging to another consumptive family that person's children will almost to a dead certainty inherit consumption in its worst form. Some of them will die as infants; most of them will probably grow to be eighteen, nineteen, twenty, or twenty-one, and then they will all die as if cut down by a scythe. I have seen it over and over again.

Now, take nervous diseases—the other illustration I have given. If a person belonging to a family in which nervous diseases are prevalent marries a person belonging to another family in which nervous diseases are prevalent, the children of those persons and their grandchildren will suffer from nervous diseases almost to a dead certainty of the worst type, and almost to an equal certainty will furnish inmates to lunatic asylums. I might go on to speak of other hereditary diseases, but those two illustrations are sufficient to show what I mean. It is of the greatest importance, and it is the duty of the sanitarian to insist on it that persons should not marry other persons subject to the same diseases as they are.

Now, at this time of life it is necessary to choose a house or habitation, and I need hardly insist upon it, as I feel that I must get on, that it is necessary a man should take care as far as his means will allow that the house is in a properly sanitary condition, that the drains, if there are any (happy is the man who has a house without drains), are in good order and the rooms well arranged as to ventilation and light. This is a subject too often overlooked. If you want your children to be healthy and strong one of the first things to be done is to give them a house as healthy as possible to live in.

Now, I will pass on at once to middle age. This is what you may call the stationary period of life. Life has been compared to a hill with a gradual slope upwards, a long plateau at the top (which is the latter part of manhood and middle age), and then a steep decline. In middle age the mistake that is gene-

rally made is that people do not take enough exercise. They begin to get stout—that is because they take too much food or take too little exercise, or because they make both mistakes. Now, at this period of life it is important that a sufficient amount of exercise should be taken, and it is also important that too much food should not be taken. One well-known hygienist has said that in youth the most harm is done by taking too little food, and that after forty the most harm is done by taking too much. At this time of life the results of habits begin to show themselves, and the diseases that are caused by bad habits begin to become chronic.

If the habit of cleanliness has not been observed during the earlier periods of life, at this time of life the skin will not do its work properly. At this period of life even in the most healthy persons the action of the skin becomes sluggish, and the less the skin acts the more is this action thrown on the internal organs—the lungs and kidneys. At the same time very likely at this period the lungs and kidneys have become weakened, and so if the skin does not act those organs are still more likely to become diseased; therefore, as cleanliness is important in all periods in middle age, it is exceedingly important not only to encourage exercise, but to encourage the action of the skin by tepid or warm baths, so as to prevent the work which the skin ought to do from being thrown on some of the internal organs.

We pass on to old age. Now, in old age we come again to the danger that we mentioned once before. The great danger in old age as in infancy and childhood is from the external cold, though the reason of course is quite different. The reason why the danger in old age is from the external cold is that old people do not produce heat enough. Their respiration is slow; their circulation is slow. The amount of oxidation by which heat is produced that is going on in their blood is little, and so they do not produce heat fast enough, and cannot afford to lose it, so the great danger is from the external cold. They are chilled, and get generally bronchitis or inflammation of the lining membrane of the air passages of the lungs. That is the great agent of death in old age; so that the most important precaution in old age besides carrying out the precautions of previous periods is to avoid external cold, not to be exposed in cold weather, and to wear warm clothing.

And now we reach "the last scene of all," as Shakespeare says,—

> "That ends this strange eventful history,
> In second childishness and mere oblivion;
> Sans teeth, sans eyes, sans taste, sans everything."—

decrepitude. Now, what are the mistakes made in this period

of life? Who are the people that reach this period of life? They are the people who in the first place I may tell you have chosen their parents well. No people reach this period of life who have not had aged parents. Those who reach this period are those for whom the mistakes of infancy and childhood have not been made by their parents, who have been properly trained in youth and have contracted good habits, who have not committed the excesses of youth or of manhood, who have avoided all the mistakes made in middle age, and who have not exposed themselves to the external cold in old age. The people who have not made the mistakes they see others make around them are those who reach the last stage of life so graphically described by Shakepeare. Why do they die? you may ask. That is not so easy to answer. They die for a reason which is not so simple. During the whole period of life a process of hardening of the tissues goes on. I cannot describe it to you in this lecture. From the earliest condition of the human being the hardening process goes on to the advantage of the individual up to his manhood. After that it goes on apparently neither to his advantage nor to his disadvantage, but really slightly to his disadvantage. Then it goes on until he begins to feel the effects of it. The elasticity of the skin disappears, and it becomes wrinkled. The elasticity of the lungs becomes diminished, and they do not expel the air so well. Later on—a thing which I am feeling already—the eyesight is not so good as it was before, the sense of feeling is dulled, the sense of hearing is not so good, and from the hardening of the nerves, and from this continuous hardening of the tissues, there comes an end of life; for this process which goes on to the advantage of life up to a certain point goes on afterwards until either the lungs become so hard that they no longer force the air out, or the arteries become so hard that they prevent the heart forcing blood through them, and the man either ceases to breathe or his heart ceases to beat. That is why we must die. We cannot live for ever.

THE ESSENTIALS TO HEALTH—AIR, WATER, AND SUNSHINE.

LECTURE TO THE WORKING CLASSES,

By Henry Law, M.Inst.C.E., F.R.Met.S.

I propose to devote the few minutes at my disposal this evening to saying a few words on the three essentials to health, namely, air, water, and sunshine.

I need say nothing to convince you that air is not only essential to health, but even to life, as we all know that to be deprived of air for only a few minutes produces death; consequently the whole earth is surrounded with a covering of air, so that wherever human beings may wander there is the air present to sustain life. The air is composed almost entirely of two gases, named *oxygen* and *nitrogen*, in the proportions (by weight) of one of the former to three and a half of the latter; and it supports life by being drawn into the lungs, where it is brought into contact with the blood, which the *oxygen* contained in the air purifies and renders fit for nourishing our bodies; it is then discharged from the lungs, but no longer in a condition fit to be breathed, as it has lost much of its oxygen, and now contains a deadly substance, called *carbonic acid gas*, besides other impurities. Such being the case, you will readily understand how necessary it is to healthy life that the same air should not be taken more than once into the lungs, and therefore that the air which we have breathed should be continuously changed, opportunity being given for its escape, and for its being replaced by fresh air in its pure state.

Now at the present time the population of the earth may be taken at about 1,500 millions, and each person renders about 3,000 cubic feet of air impure per hour; therefore, the whole population of the earth renders impure and unfit for healthy

life, in every day, a quantity of air which would fill a space equal in area to the whole of England, and 77 feet in height. But the breathing of human beings is only one, out of many causes, which renders the air impure and unfit for breathing,—amongst which may be mentioned the breathing of animals, the burning of coal, wood, gas, oil, &c., to produce heat and light, and the decay and putrefaction of vegetable and animal substances. Although, therefore, the atmosphere contains upwards of 1,000 millions of cubic miles of air, or about three-quarters of a cubic mile of air to each person, it is evident that, in order to preserve the air in a state fit to sustain healthy life, means must be provided for restoring it to its original purity.

With that simplicity and perfection which mark all the arrangements of nature, these means are provided, and consist first of a property which all gases possess of diffusing themselves equally throughout space, so that, although carbonic acid gas, which I told you was thrown out of the lungs, is very much heavier than the general air, and would naturally fall to the ground, and there remain, and would in the course of a few years render the air near the surface of the earth unfit for the breathing of human beings; so perfect is the result of the action of this property, which is termed the *diffusion of gases*, that wherever the air is examined, whether in the bottom of the lowest valleys or on the tops of the highest mountains, the quantity of carbonic acid gas is found to be the same.

But it is not sufficient that this deadly gas should be dispersed equally throughout the whole atmosphere, for a very slight increase in its quantity renders the air unfit to breathe, and unless some means existed by which it was removed, it would gradually accumulate until the whole atmosphere became unfit to support life.

And again, we have the means provided for its removal, as universal and as constant in its action as is the cause of its existence; namely, by the property which plants possess, when aided by the presence of light, to decompose the carbonic acid gas, seizing upon the carbon to form its own substance, and setting free the oxygen, to render the air pure again and fit to breathe.

Water, the second essential to health, covers about three-fourths of the whole surface of the globe, and is also composed of two gases, of which *oxygen* is one, and the other is named *hydrogen*, united in the proportion (by weight) of eight of the former to one of the latter. Water, however, either in the solid, liquid, or gaseous state, is found everywhere, for the air contains one-seventieth of its bulk of water as vapour; while

nearly three-fourths of our food consists of water, and it composes a very large proportion of our bodies and of the solid substance of the earth.

Water, in a similar manner to the air, is exposed to a great number of circumstances which render it impure; and were there not also other circumstances constantly at work to purify it, would soon be rendered unfit to sustain life. The two most general processes by which water is, in nature, restored to its original state of purity are those of *distillation* and *oxidation. Distillation* consists in the water being converted into vapour by the heat of the sun, forming fogs and clouds, which are free from most of the impurities which existed in the water; and these clouds being condensed in the form of rain or dew, and so being restored to the earth in the form of pure water. The other process by which impure water is rendered pure, is that of *oxidation*, which consists in the oxygen of the air becoming mixed up with the water, by their being more or less violently agitated together by the action of the wind, or the motion of running streams; the result being that the oxygen enters into combination or union with the impurities in the water, and by so doing completely changes their nature, and renders harmless, substances which in their original state were deadly poisons.

There is another agent which prevents both water and air from becoming stagnant and unfit for supporting healthy life, and this brings me to the third essential to health, namely, sunshine.

We all know that the sun is the great natural source of light and heat, and that rays of light are always proceeding from the sun in all directions with a speed so marvellous as to be beyond our realization; for, although the distance of the sun is about 93,000,000 miles, light takes only eight minutes to travel from the sun to the earth, being at the rate of about 195,000 miles per second, or 300,000 times faster than the shot thrown from one of our most powerful guns, and nearly 1,000,000 times quicker than the rate at which sound travels. We occasionally have this fact of the greater velocity of light than that of sound rendered evident to us, by the familiar fact that lightning is always seen before the thunder is heard, although both occur at the same moment.

Now the two properties of sunshine with which we are most familiar are those of light and heat, but there are others of equal importance which are not so evident to our senses. You have, however, all of you seen photographs, and probably are all aware that they are produced by the rays of the sun, which exert what is called *chemical* action on many substances. Again, most of you have heard of *electricity*, the great

agent which is the cause of thunderstorms,—the agent which enables us to send messages by the telegraph from one end of the earth to the other in an incredibly short space of time, or to hold conversations by the telephone between parties situated many miles apart; and this agent of electricity is only sunshine in a different form. Many of you, again, have heard of *magnetism*, which causes pieces of iron which have been subjected to its influence to attract and hold all other pieces of iron, and further, causes the *magnetic* needle, or *compass*, as it is termed, always to point in a northerly direction, by which means the course of vessels is determined at sea, and without which the navigation of vessels would be rendered exceedingly difficult, and only possible with speed and safety when the sky was free from clouds. This agent, which we term *magnetism*, is again only sunshine in another form.

It is, however, only with those properties of sunshine which affect health that I have to do to-night, and these are *heat*, *light*, and *electricity*. The first thing which I have to observe in reference to heat, light, and electricity, is that they are all capable of being converted one into the other, and of producing *motion*.

Now, whenever any body, having weight, is in motion, it can only be stopped by some force or effort opposed to it, which is familiarly expressed by saying that any body in motion will do a certain amount of *work* in being brought to a state of rest; and the *work* thus done is called *vis vivâ*, or *living force*. A certain amount of this living force exists in the universe, and has so existed, without increase or decrease, from the creation; no force is ever lost, it may change its form and become locked up, or disguised, but it cannot be destroyed. Thus, *living force* in the form of *electricity*, acting from my brain on my nerves and muscles, at the present moment, enables me to move and to speak to you; my voice only reaches you and is heard, because I have thrown the air into motion, and by creating waves of varying lengths produce on your ears the sensation of particular sounds and words; that sensation is only conveyed to your brains by living force in the form of electricity, and the waves which I produce in speaking, gradually impart their living force to matter around.

Now the great storehouse of living force is the *sun*, and the means of conveying that force to the earth is *sunshine*. Ages back this same sunshine produced, upon the earth, heat and light, and caused the growth of enormous forests, the remains of which we now find buried in the earth in the form of coal, and from which we are able to obtain again the living force there stored up for our use.

At the present day, the heat from the sun continually produces motion in the air and water, which form the atmosphere and ocean, and by this continual movement, restore both of them to that state of purity which is essential to healthy life.

Thus, the heat of the sun causes the air upon which its rays more directly fall to expand and become lighter than before, and so rise from the surface of the earth, while the cooler and heavier air rushes in from all sides to fill the space thus left, and this movement of the air is familiarly known to us as wind.

Again, the heat of the sun, as I have already mentioned, converts a portion of the water of the ocean into vapour, which rises into and mixes with the air, remaining there in an invisible state until a change of temperature causes it to become condensed into clouds, and ultimately to fall as rain; and by this process the air is being continually washed and cooled.

Further, the heat of the sun has the same effect on the water of the ocean as it has on the atmosphere, producing constant movement, and thus preventing the water from becoming stagnant and unfit to support animal life.

I have already told you that a certain amount of living force exists in the universe, of which none is ever lost or destroyed, but which reappears in various forms, which we term *light*, *heat*, *electricity*, *magnetism*, *sound*, *and motion;* so also with matter, or the material substances of which the universe is composed. Matter in the universe is constant in quantity, and cannot be lost or destroyed; its form may be changed, it may be converted into a liquid or an invisible gas, but not one particle of it has been lost. We may burn any substance so as to entirely consume it, and leave only a few ashes visible, but nothing has been destroyed; and if the combustion was performed in an enclosed space, so that nothing could escape, we should find every grain of every substance that originally existed in the article burnt still there, although possibly in a form very different from its original state.

Notwithstanding the enormous variety of different substances which exist in the world, there are but comparatively few *elements* of which they are composed; for the most extraordinary changes and differences of property and character are produced by a very small variation in the quantity of one of the elements which compose the substance; and even sometimes the same elements, united in the same proportions, differ in the most remarkable manner, simply because they are arranged in a different manner. Thus, one of the most corrosive substances known, namely nitric acid, or *aqua-fortis*, is composed of exactly the same elementary substances as the air which we breathe, namely, oxygen and nitrogen, the only difference being that

they are united in different proportions, and in a different manner. In fact we can convert the pure, harmless air which we breathe into the corrosive aqua-fortis, by simply sending through it a current of electricity in the form of sparks. As a matter of fact, the great bulk of the materials of which the earth, and all that it contains, is composed, consists of some half dozen elementary substances, of which the constituents of air and water form a very considerable part.

As regards light, or sunshine, it is not only essential to health as the means by which air and water are restored to a state of purity, but it has its own direct influence on our health and comfort. It is the great discoverer of dirt, and as such the good housewife's best friend. Light is necessary in order that the animal spirits may be constantly refreshed and invigorated. Light assists the due nourishing of our bodies by food, and sustains our blood in a healthy state, and gives the rosy colour of health to the cheeks of our children.

Recent researches have fully established the fact that both air and water, when impure, contain germs which are injurious to health, and that it is equally injurious that the air which we breathe should contain an undue quantity of water, mixed with it in a state of vapour. If the walls of our houses are damp, or the house liable to be surrounded with puddles of stagnant water, or if dirt is allowed to accumulate, the air will be rendered moist and impure; and if the water which we use for drinking and cooking purposes is exposed in an open cistern, it will absorb the impurities which exist in the air.

A very large proportion of the diseases from which we suffer are the result either of our breathing impure air, drinking impure water, or having an absence of light in our dwellings. In fact, there are a class of diseases which have been aptly named *filth* diseases, such as cholera and typhus fever, which, if there were no such things as impure water and air, and if our dwellings were light and well ventilated, would become unknown. And yet we have it on one of the highest authorities, namely, the late Dr. Farr, that not less than one-seventh of the population die from filth diseases.

Allow me then, in conclusion, to give you a few practical hints for securing as large a share as possible of the benefits resulting from the possession of the three essentials of health of which I have spoken.

To obtain the first essential of pure air, the house, furniture, and clothes should be kept as clean and free from dirt as possible: the walls are far better distempered instead of being papered. The floors should be stained and varnished or painted, the carpets being loose, so as to be frequently taken up and

beaten; the heavy pieces of furniture should be on castors, so as to be easily moved. In the kitchen the brightness and cleanliness of the cooking utensils should be the careful housewife's pride. In the bed rooms the furniture should be scanty and simple—iron bedsteads and no curtains or valences; floors should be frequently scrubbed, and only strips of carpet by the bed-side. Every living and bed room should have an open fireplace and opening windows. The beds should always be thrown open for some hours after being slept in: it is a great mistake to make the bed immediately after having been used; this is a case in which tidiness must give place to health.

I have explained to you how the act of breathing renders the air unfit for healthy life, you will, therefore, at once see how detrimental to health it must be to crowd too many persons into one room, and this is specially so in the case of bed rooms, for during sleep the nervous power is low, and the person is far more susceptible to receive harm from the impure state of the atmosphere. I know that the desire for warmth is one of the chief reasons why the grate is frequently closed by a board, and every crevice for the admission of fresh air, either at the door or window, is carefully closed with sand bags and list. I recollect how the Irish peasant, on being remonstrated with for the crowded state of his cabin, said:—"that it was so cold without the pig." But if you will only try the experiment of admitting plenty of fresh air into your bed rooms, you will find your sleep far more refreshing.

It is equally important to attend to the surrounding of your dwelling outside, the ground should slope away from the walls, and should, if possible, be paved, or at least firm and hard, so as not to remain in a damp state; and if you have any spare ground it should be cultivated as a garden.

If the water is supplied to you in a cistern, you should have it frequently cleaned out, and always kept covered with a properly fitting lid.

Now I have had a great deal to do with working men in my life (in fact I claim to be one myself), and I have always found them very open to conviction and amenable to reason, and therefore having thus briefly shown you the importance to your health and comfort of pure air, pure water, and plenty of sunshine, I feel confident that you will do your best to secure these blessings without further urging on my part.

SELF-PRESERVATION AND EPIDEMIC DISEASES.

ADDRESS TO THE WORKING CLASSES.

By J. F. J. Sykes, B.Sc. (Public Health), M.B.

Self-preservation stands out as the great guiding instinct of all living organisms, the preservation of life and health being fundamentally necessary to secure food for nutrition, and to reproduce the kind for perpetuation of the species. Yet, strange to say, man, whilst striving to protect his life against enemies, to increase his food supplies and other necessities, to reproduce and develope his kind, has, until quite recent years, been less successful in the preservation of his health and life against disease, with the result that he has been decimated by plague and pestilence in the past, and by epidemics in more recent times. It may be interesting to inquire why this most powerful instinct has been followed at so great a distance by man in defence against disease, especially that of an epidemic character.

In order to obtain a clear idea of the matter, we must understand something of the incidence of disease—the enemy, and of the social condition of man—the victim.

Disease may be inherited or acquired. The amount of actually-inherited disease is very small, compared to the total amount of disease prevailing; but the amount of inherited predisposition to disease is large, inasmuch as our constitutions are inherited from our parents, and constitution is the important factor in predisposition to disease. Disease may often be apparently inherited, when in reality it is but the constitution predisposing to the acquisition of disease that is inherited. It is important, therefore, for parents to cultivate and maintain sound constitutions to hand down, as a precious inheritance, to

their offspring. The ill results of in-breeding by inter-marriage of blood-relations, has been observed from time immemorial; but the disastrous results of the inter-marriage of persons inheriting like predispositions to disease are not even now sufficiently realised and avoided. Heine said truly that a man should be careful in the selection of his father and mother.

Acquired disease may be due either to physical or chemical agents not possessing life, or to living agents capable of reproducing themselves indefinitely. To the former class belong the functional and organic diseases, and to the latter the parasitic and zymotic diseases. That climate, situation, soil, diet, and habit largely influenced disease of organs of the body and of their functions has been known from time immemorial, and that the large visible parasites were also known as the cause of disease from time immemorial is shown by the fact that man became a cooking animal, and the first object of cooking is sterilisation, or the destruction of living organisms in the food. But that small, invisible, or micro-parasites, should be the cause of what are now called zymotic diseases, is a fact that has only been realised within the last half century, and until the fourteenth century it was not even realised that it was possible for epidemic or infectious diseases, which are now known to be due to these invisible parasites, to be communicated from person to person, directly or indirectly, but were invariably attributed to the direct visitation of God, and no means whatever taken to prevent their spread, until in 1399 Count Bernardo in Italy instituted quarantine.

Invisibility of the causes and consequent ignorance of the methods of attack of infectious diseases will thus be seen to have been one of the reasons for defective defence against them. Prolonged observations unmasked the methods of attack, and quarantine was established in defence. But since that day multitudinous researches have laid bare the causes of these diseases, and now the nations are learning by bitter experience that that method of defence was faulty; that infectious diseases cannot be kept at bay by big battalions, however heavily their guns may be loaded or whatever the length of their bayonets; that they can only be checked by continuous and persevering control in detail, and not by spasmodical and hurried envelopment by masses of troops, or absolute exclusion of mercantile fleets. Soldiery and police are giving way to sanitary officers.

But this invisibility of the cause and of the methods of attack must still be largely reckoned with. It accounts for much of the callousness displayed towards infectious diseases, and stimulus to self-preservation can only be imparted by

educating the knowledge of the people to a sense of the danger that lurks unseen and unknown in every person, object, and dwelling infected. This reckless callousness is sometimes displayed by mothers and nurses, with infants on arm and children by their side, paying visits of sympathy to the bedside of those suffering from infectious disease or of condolence to the death-chamber; at other times, from compassion upon the cooped-up invalid, by the laxity with which child or adult is released to mix with playmates or companions whilst but convalescent from infectious disease; at other times, by the kindly gift, a needy sale of some infected article of dress or furniture; and in many another simple and unheeded manner.

The facts are but partially known, and where known little regarded, that infection imperceptibly taints the clothing and food, the water and the air, and through these travels from person to person; that infectious disease prostrates with sickness, and, when it does not kill, frequently maims the internal organs, permanently handicapping children and adults in the battle of life.

Fatalism is another cause that has paralysed action against infectious disease. Man arrogates to himself the moulding of events, the cause and effect of which he has knowledge oblivious then of his Maker, but events, of the cause and effect of which he is ignorant, and of which he dreads to place on record that his duty is not yet accomplished in learning to read and to obey the natural laws of the Almighty, he hands over the responsibility to his Maker in the words "visitation of God," and it is recorded as "ignorance of man." This fatalism explains the helplessness that populations in former days yielded to in the face of epidemics for fear of offending the Almighty.

Something of this spirit still remains, and the idea that what are sometimes called children's complaints, which mainly consist of infectious diseases, are bound to be experienced at some period of life by every individual is not yet rooted out. Nor is the idea that it is better to have a disease whilst young rather than later in life. These are both exploded fallacies, and the wider the knowledge is spread that there is no necessity to undergo such diseases at all, the better for the present and for future generations.

M. Pasteur, the eminent French chemist and biologist, in the Croonian lecture delivered before the Royal Society in the spring of this year, stated that the virus or germ-poison causing certain infectious diseases, can be so attenuated or weakened by cultivation after cultivation as to be rendered perfectly innocuous, and he further stated that by reversing the process and passing an innocuous germ-poison successively through the bodies of

animals, commencing with one just born up to the adult animal, that this living poison can be so fortified as to become extremely virulent and rapidly fatal. The words of Pope almost fit the process:—

"As man, perhaps the moment of his breath,
Receives the lurking principle of death,
The young disease, that must subdue at length,
Grows with his growth and strengthens with his strength."

This leads us to presume and experience points in the same direction that infectious diseases, commencing in a mild form and affecting infants in the first place, may ultimately, under neglect, become very virulent, increase in infectiveness and destroy the adult population; and, *vice versâ*, that by protecting the adult population from attack by suppressing it in the children, it may be so reduced in viruleuce as to run but a mild course in those that are attacked. It is surmised that scarlet fever is being so affected in some localities where infectious disease is being efficiently restrained.

The lesson this teaches is to nip the disease in the bud, to curtail it in infancy, and to prevent by all means its extension, and so, to preserve not only the infant, but also the adult population from decimation by epidemics, and it must be remembered in this connection that infancy is the age most prone to infectious disease.

The idea that it is better to have these diseases when young has also been dissipated by the statistics published in a recent Annual Report of the Registrar-General, wherein it is shown that scarlet fever is most frequent and most fatal amongst the very youngest children, and that this frequency of attack and also the fatality of those attacked, gradually diminishes up to middle life, so that the longer the disease can be staved off, the less chance there is of being attacked, and, if attacked, the less chance there is of dying from the disease. Such facts destroy the fatalistic idea root and branch, and encourage you to treat no longer the infants' infectious complaints with scorn and neglect, harbouring and strengthening an insidious enemy into life in the warmth of your hearth.

Individualism, under the plea of which the individual claims perfect freedom of action, is another cause that has hitherto stood in the way of preventing the spread of infectious disease. Although it has been a boast that "an Englishman's house is his castle," it has not prevented the King or the State from invading that castle whenever it contained criminals, nor from searching it when it contained explosives, and now the State recognises that contagious poisons are equally as dangerous to

the community as explosives or criminals. That public opinion, which maintains for defensive purposes a navy and an army against external enemies, and a police against internal enemies, now recognises the necessity for defence against the most domestic enemies. For self-multiplying, living parasites are as truly enemies as any foreign foe, and fight with as fatal results. More armies have been destroyed by the parasites of epidemic disease than have ever been destroyed by man.

The *instinct* of self-preservation from a neighbour's disease, with the growth of knowledge of the means, is proving itself stronger than the *sentiment* of "castledom." The conditions of modern life impel us in this direction; formerly dwellings stood isolated from one another, gradually they have approached each other, until they now not only share the same party walls, but rest upon one another in "floors," with staircases and air supply in common. We now not only dwell side by side, but also layer upon layer, like sardines in boxes, bathed in a common fluid. We dwell under exceptional conditions, brought about by the combined action of the members of communities crowded together in cities, and the combined action of the community is also requisite to maintain the health of its members. The closer and closer we live together, the more and more mutual our interests become, and the more subservient our acts must become to the benefit of the community rather than to the caprice of each one's particular fancy.

"Love thy neighbour as thyself," especially in matters of health. The health of your neighbours is the barometer of your own, and your freedom must not be restricted through sickness by the too great freedom of your neighbour. Resentment of interference, coupled with indifference to others, still strongly prevails in sanitary questions. A London daily paper recently expressed this doubtful form of independence in these terms, to the tune of the Roast Beef of Old England:

When good Queen Victoria came to the throne,
Very little of "germs" and "baccili" was known,
And a cesspool lay lurking beneath every stone.
    Oh! the old smells of old London!
    And oh! the old London old smells!"

Times are changed!

"We rejoice in a hundred most eminent firms,
Who will "drain" us and "trap" us on moderate terms,
And secure each man's right to his own household "germs."
    Oh! the new smells of new London!
    But oh! the new London new smells!"

And secure each man's right to his own household germs.

As an illustration of securing this right, this is what was told me at a village where I was recently staying. The village is of considerable size and lies in an open valley, half surrounded by hills, on which stand, in their own grounds, a great number of mansions, and houses of well-to-do men from a large town a short distance away. The village has no water supply of its own, but a small supply has been laid from the adjacent large town, which unfortunately cannot be utilised on account of the absence of sewers, or of other means for the proper riddance of any overflow of waste water. So this village exists by shallow wells and absorbent cesspools. The villagers desired a sewerage system to relieve this serious condition, but the well-to-do surrounding residents who lived upon higher levels, and who had provided themselves with good water supply and drainage, each independently in his own grounds, assembled with their friends and outvoted the villagers. They preferred the chance of an epidemic amongst the villagers to an increase of rates. An Italian proverb says—"Money is dearer than life to the rich man." But if an epidemic break out in that village, it cannot fail to be carried with the supply of necessities into the houses of these same well-conditioned folks to which their highly nurtured and expensively trained offspring will fall ready victims. There is now a further movement amongst the inhabitants of this growing village to establish a local board of health of their own, for they are ruled from a town that lies some nine miles distant, and they will endeavour to possess, under their own control, a water supply and a drainage system, an infectious hospital, and proper sanitary supervision. Let us wish them success.

As this spirit of individualism has found its most able advocate in Herbert Spencer, the philosopher, I will quote a passage from his Social Statics:—"That it comes within the proper sphere of government to repress nuisances is evident. *He who contaminates the atmosphere breathed by his neighbours, is infringing his neighbour's rights.* Men having equal claims to the free use of the elements, having faculties which need this free use of the elements for their due exercise, and having that exercise more or less limited by whatever makes the elements more or less unuseable, are obviously trespassed against by any one who unnecessarily vitiates the elements and renders them detrimental to health or disagreeable to the senses; and in the discharge of its functions as protector, a government is obviously called upon to afford redress to those so trespassed against. Beyond this, however, it cannot lawfully go. As already shown in several kindred cases, for a government to take from a citizen more property than is needful for the

efficient defence of that citizen's rights is to infringe his rights; is, consequently, to do the opposite of what it, the government, is commissioned to do for him; or, in other words, is to do wrong. And hence all taxation for sanitary superintendence coming, as it does, within the category, must be condemned."

An astounding conclusion, the reasons that lead to it being that sanitary supervision is not conducive (1) to economy, nor (2) to the survival of the fittest.

As to economy, let alone humanity, hear what Carlyle says:—"One of Dr. Alison's Scotch facts struck us. A poor Irish widow, her husband having died in one of the lanes of Edinburgh, went forth with her three children, bare of all resource, to solicit help from the charitable establishments of that city. At this charitable establishment and then at that she was refused; referred from one to another, helped by none; till she had exhausted them all; till her strength and heart failed her: she sank down in typhus fever; died, and infected her lane with fever, so that 'seventeen other persons' died of fever there in consequence. The humane physician asks thereupon, as with a heart too full for speaking: Would it not have been *economy* to help this poor widow? She took typhus fever and killed seventeen of you! Very curious. The forlorn Irish widow applies to her fellow-creatures, as if saying: 'Behold I am sinking, bare of help; ye must help me! I am your sister, bone of your bone; one God made us; ye must help me!' They answer: 'No, impossible; thou art no sister of ours!' But she proves her sisterhood; her typhus fever kills *them:* they actually were her brothers, though denying it!"

As to the survival of the fittest, we may ask: Who are the fittest that ought to survive? Who knows? So far as the direct struggle for existence between man and his parasites goes, we may safely say that the parasites are not the fitter as eligible citizens. If on the other hand it be pleaded that the effects of these same parasites is to prove the superiority of a people that can survive their attacks to some others that cannot, then the same will hold good of wolves. We have done wrong in exterminating wolves in this country if they are a test of our powers of survival. We have done wrong in not adopting the Spartan method of testing the strength of our infants, by floating them alone in their helplessness upon the cold waters of the stream, and in many other ways must we have done wrong. But infectious diseases do not necessarily attack only the weakly, they attack the strong also, and maim them when they do not kill. They attack in preference the young, truly, but the child is the future man, and young is not synonymous with weak; Children are helpless but not necessarily weak.

But if all "sanitary superintendence" were abolished, what would be the result? We have the experience of former generations in neglecting sanitation and control over infectious diseases, but the remote past shows the strongest contrast.

Professor Corfield's words are to the point when he said, in speaking on the present state of the sewage question, "I was very much struck by a remark that Dr. Acland made to me the other day upon this subject. He said: 'What do you think was the cause of the depopulation of so many of the cities of antiquity? I think it was pestilence rather than war!' And I think there can be little question when you read the accounts. Why, the black death not only decimated towns, but almost entirely depopulated whole places; so that large and populous cities were left little straggling villages. I think you will be disposed to agree that it is not unlikely that many of the great cities were entirely depopulated in this way, and were lost, so that in some cases even their site is not known."

Another aspect of this narrow view of economy is afforded by the trader who resents interference and considers his own particular profits of such paramount importance that he does not hesitate in distributing to his fellow citizens the milk that has received infection from his household. Carlyle in his incisive manner thus handles a parallel case:—"'What is to become of our cotton-trade?' cried certain spinners when the Factory Bill was proposed; 'what is to become of our invaluable cotton-trade?' The humanity of England answered steadfastly: 'Deliver me those rickety perishing souls of infants, and let your cotton-trade take its chance. God Himself commands the one thing; not God especially the other thing. We cannot have prosperous cotton-trades at the expense of keeping the Devil a partner in them?'"

Turning from philosophy to the preservation of health. Pure food you can obtain by careful selection and by cooking. Pure water too you can obtain by careful selection, and where this has been neglected, cooking also is still a wise precaution. But pure air you cannot obtain by any amount of cooking or selection. You must depend upon your scavenging and sewering without, and your drainage and ventilation within, by isolation and disinfection in infectious diseases; a refuge for your poor in infectious sickness, and the protection of the healthy from attack; and a diffusion through your midst of a knowledge of the course and effects of infectious diseases. Much can be done for children in the course of education by instruction in the plain facts of living and the laws of health, and for adults by the guidance that can be afforded, to their less

favoured brothers and sisters, by the wealthy and leisured associated together to spread the knowledge of sanitation.

The moral of self-preservation has at first blush the ringing sound of a supremely selfish act; but when the enemy comes in the form of disease that cannot be fought in a spirit of individualism, but must be repulsed with a spirit of socialism—in the truest sense of the word—and with a love for your neighbour as great as for yourself, when you appreciate that in preserving the child you preserve the man, that in preserving your neighbour you preserve yourself and your kindred, then does self-preservation call forth the kindest motives and the most unselfish acts; then is the sanitary worker, whether voluntary or official, no longer looked upon as an intruder, but welcomed as an advisor and protector; and when neglect of those precautions that should have been taken result in the death of a neighbour, let it not be recorded against you in the Judgment Book that you asked, "Am I my brother's keeper?" You are!

EXHIBITIONS HELD IN CONNECTION WITH THE CONGRESSES OF THE INSTITUTE.

	1877. Leamington.	1878. Stafford.	1879. Croydon.	1880. Exeter.	1882. Newcastle.	1883. Glasgow.	1884. Dublin.	1885. Leicester.	1886. York.	1887. Bolton.	1889. Worcester.
Number of Exhibitors	117	116	189	106	110	126	134	135	130	112	108
Number of Exhibits	294	319	710	500	600	750	900	1,000	900	800	800
Space occupied (in square ft.)	......	......	......	9,725	14,520	20,000	40,000	30,000	30,000	25,000	28,000
Number of days Exhibition was open	14	16	17	19	25	25	19	17	26	29	23
Total number of Visitors	......	......	......	8,955	8,373	20,000	35,000	37,000	30,000	27,000	23,000
Number of Medals awarded	13	13	12	12	15	21	18	34	16	14	22 *
Number of Special Certificates	None.	6	9	7	4	13	11	11	12	9	None.
Number of Certificates	None.	22	38	40	72	58	83	79	64	40	55 *
Number of Exhibits deferred for further trial	......	7	52	30	37	44	39	119	42	46	67

* These do not include any awards which may be given for Deferred for further practical trial Exhibits.

LIST OF THE AWARDS AT THE WORCESTER EXHIBITION.

The letter **M**, followed by the date in heavy type, signifies a Medal.
The letter C, followed by the date in ordinary type, signifies a Certificate.

MEDALS.

Improvements in Pharmaceutical Preparations. *Burroughs Wellcome & Co.* **M, 1889.**
Carbolic Acid Preparations. *F. C. Calvert & Co.* **M, 1889.**
Carbolic Soaps. *F. C. Calvert & Co.* **M, 1889.**
Cellular Clothing. *Cellular Clothing Company.* **M, 1889.**
Street Sweeping Machine. *Clemens, Abell & Co.* **M, 1889.**
"Cecil" Slop Sink. *Joseph Cliff & Sons.* **M, 1889.**
Nursery Bath. *J. Cliff & Son.* **M, 1889.**
"Roman" Bath. *J. Cliff & Son.* **M, 1889.**
Toilet Soap. *E. Cook & Co.* **M, 1889.**
Nicholl's "Eclipse" Soot and Salt Closet. *Henry Dean.* **M, 1889.**
Excellence in Manufacture of Water Fittings. *Guest & Chrimes.* **M, 1889.**
Caink's Automatic Pressure Changing Station Gas Governor. *Guest & Chrimes.* **M, 1889.**
Defries Safety Lamp. *Geoffrey Harrison.* **M, 1889.**
Surgical Dressings. *The Liverpool Lint Company.* **M, 1889.**
Washington Lyon's Steam Disinfector. *Manlove, Alliott & Co., Limited.* **M, 1889.**
Fryer's Destructor with Jones's Cremator. *Manlove, Alliott & Co., Limited.* **M, 1889.**
Alliott & Paton's Filter Press, with Pneumatic Attachment. *Manlove, Alliott & Co.* **M, 1889.**
Preserved Fruits. *Vale of Evesham Fruit Preserving Company.* **M, 1889.**
Grahtryx Fan-Light Opener. *J. Ward & Sons.* **M, 1889.**
Ruffard's Porcelain Bath. *J. Ward & Son.* **M, 1889.**
Ruffard's Porcelain Bath. *R. W. Tomlinson.* **M, 1889.**
Exhibit of Flooring and Wall Tiles. *Webb's Worcester Tileries Company.* **M, 1889.**
Exhibit of Art Porcelain. *The Worcester Royal Porcelain Company, Limited.* **M, 1889.**

CERTIFICATES.

Improved Tumbler Cart. *Clemens, Abell & Co.* C, 1889.
Watling's Tip Wagon for Scavengers. *Clemens, Abell & Co.* C, 1889.
Improved Street Watering Van, with Double Distributors and Valves. *Clemens, Abell & Co.* C, 1889.

Improved Air-tight Manhole Cover. *A. T. Angell.* C, 1889.
Air-tight Soil Pail. *William Bennett & Co.* C, 1889.
Thomasson's Inlet Ventilator. *William Bennett & Co.* C, 1889.
"Bland" Copying Machine. *W. Bland & Co.* C, 1889.
Anatomical Boots. *Nathaniel Bletchley.* C, 1889.
"Vinolia" Soap. *Blondeau & Cie.* C, 1889.
Lano Creolin. *Burroughs, Wellcome & Co.* C, 1889.
Cocoa. *Cadbury Bros.* C, 1889.
Enamelled Fire-clay Hospital Sink. *Joseph Cliff & Sons.* C, 1889.
"Beancliffe" Disconnecting Trap. *Joseph Cliff & Sons.* C, 1889.
"Beancliffe" Urinal Base. *Joseph Cliff & Sons.* C, 1889.
Yorkshire Salt Glazed Sink. *Joseph Cliff & Sons.* C, 1889.
Dean's Silt Gully. *Henry Dean.* C, 1889.
Hygienic Dust Bin. *Henry Dean.* C, 1889.
Durran's Metallic Jointed Air-tight Cover for House Drainage. C, 1889.
Removable Rain-water Pipes, Heads, Clips, and Hangers. *James Gregson.* C, 1889.
Self-acting Air-valves. *Guest and Chrimes.* C, 1889.
Defries Petroleum Cooking-stove. *Geoffrey Harrison.* C, 1889.
Enamelled Iron Plates for Decorative Purposes. *Hermann Heim.* C, 1889.
Solid Wood-block Floor-paving. *Holloway Bros.* C, 1889.
Jeyes' "Perfect" Purifier. *Jeyes' Sanitary Compounds Co.* C, 1889.
Edwards' Desiccated Soup. *Frederick King & Co.* C, 1889.
"Sunlight" Soap. *Lever Bros.* C, 1889.
Prepared China Grass for Surgical Purposes. *The Liverpool Lint Company.* C, 1889.
"Florador Food." *McLean & Sons.* C, 1889.
Arrangement for Releasing Horses from Vehicles in cases of Accident. *McNaught & Co.* C, 1889.
Wire Wove Roofing. *New Wire Wove Roofing Co.* C, 1889.
Millar's Reversible Window. *Millar's Patent Reversible Window Company.* C, 1889.
Chemical Heat Retainers. *Peters, Bartsch & Co.* C, 1889.
Robinson's Cement for Plastering. *Joseph Robinson & Co., Limited.* C, 1889.
Trew's Manhole Cover. *The Sanitary and Œconomic Association.* C, 1889.
"St. Bede" Disinfectant. *St. Bede Chemical Company.* C, 1889.
Model Working Dairy. *Miss F. Macleod Spooner.* C, 1889.
Dr. Bond's Regulating Filter. *Sanitary and Œconomic Association.* C, 1889.
Black's Signalling Speaking Tube. *R. W. Tomlinson.* C, 1889.
"Burton" Water Closet. *R. W. Tomlinson.* C, 1889.
"Household" Water Closet. *R. W. Tomlinson.* C, 1889.
"Tornado" Water Waste Preventer. *R. W. Tomlinson.* C, 1889.
Removable Valves for Hot and Cold Water Cocks. *H. Trott.* C, 1889.

Indiarubber Pad for Carriage Steps. *Henry Wall.* C, 1889.
Sanitary Hat Linings. *D. W. Wall.* C, 1889.
"Herald" Kitchen Range. *J. Ward & Sons.* C, 1889.
"Marlborough" Grate. *J. Ward & Sons.* C, 1889.
Shanks' Reliable Water Waste Preventer. *J. Ward & Sons.* C, 1889.
Shanks' "Tubal" Wash-out Closet. *J. Ward & Sons.* C, 1889.
"Imperial" Lavatory. *J. Ward & Sons.* C, 1889.
Cheavin's Water Filter, with Removable Plate. *J. Ward & Sons.* C, 1889.
Air-tight Manhole Cover. *Winser & Co.* C, 1889.
Enamelled Drain Channels. *Winser & Co.* C, 1889.
Stokes' Gully Trap. *Winser & Co.* C, 1889.
"Winser" After-flush Cistern. *Winser & Co.* C, 1889.
Badger's Kitchener. *Worcester Sanitary and Ventilating Company.* C, 1889.
Lloyd's "Winchester" Grate. *Worcester Sanitary and Ventilating Company.* C, 1889.

(Signed)

ROGERS FIELD, B.A., M.Inst.C.E., Chairman.
WYNTER BLYTH, M.R.C.S., L.S.A.
W. H. CORFIELD, M.A., M.D.
BALDWIN LATHAM, M.Inst.C.E.
HENRY LAW, M.Inst.C.E.
LOUIS PARKES, M.D., D.P.H.
J. WALLACE PEGGS, Assoc.M.Inst.C.E.
J. C. STEELE, M.D.
ERNEST TURNER, F.R.I.B.A.

Judges of the Exhibition.

NOTE.—Some Exhibits selected for further practical trial have not yet been decided upon by the Judges.

DONATIONS TO THE LIBRARY DURING 1889.

In addition to the works enumerated in the following list, valuable donations of back numbers of Reports and other official publications have been received from Sir Edwin Chadwick (14 volumes), Prof. W. H. Corfield (33 volumes), Dr. W. Squire (7 volumes), and Dr. Thorne Thorne (214 volumes).

⁂ *For publications of Societies and Institutions, &c., see under "Academies."*

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——— Dr. Spears' Report on a prevalence of Typhoid Fever at New Brighton, near Birkenhead.

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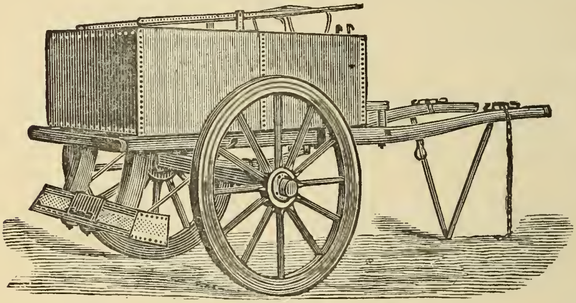

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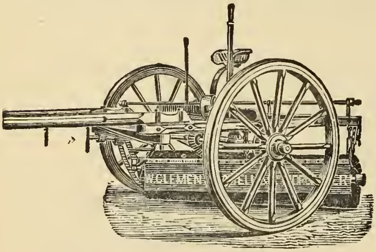

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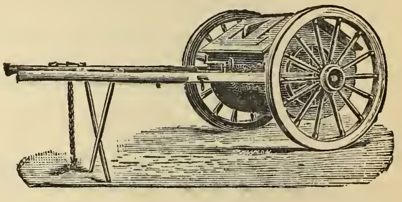

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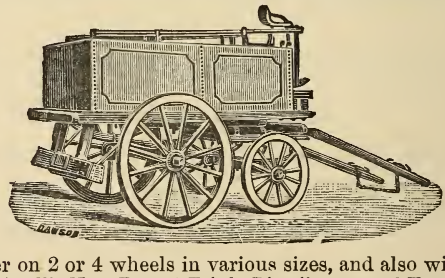

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Of normal cultivations in broth of these several microbes, about three drops were added to about three cubic centimetres of the disinfectant solution, well mixed, and after the lapse of five minutes, one to two drops of the mixture were added to tubes containing about 10 c.c. normal sterile beef broth; for control similar normal sterile beef broth was inoculated with a mere trace of the same culture fluids used for the above experiments. All broth tubes were placed in the incubator at 37° C., while all the control tubes showed already after twenty-four hours' copious typical growth of the several microbes, the others were perfectly clear and remained so afterwards. It follows from these experiments that five minutes' exposure of bacillus anthracis, of spores of bacillus anthracis, of the choleraic bacilli, and of the typhoid fever bacilli to the "St. Bede Disinfectant" solution is sufficient to kill these microbes.

2.—An important and extremely severe test of the killing power of the "St. Bede Disinfectant" solution was made in the following experiments:—

To normal human fœcal matter in thick solution, previously sterilised and contained in test tubes, was added a certain quantity of normal culture fluid of the choleraic bacilli and of the typhoid fever bacilli respectively, about one-seventh of the culture fluid being added to six-sevenths of the fœcal solution. After mixing well the disinfectant was added to each of the fœcal mixtures in equal proportions, so that each of the test tubes contained ½ of the fœcal matter plus culture fluid, and ½ of the disinfectant. After five minutes a number of test tubes containing sterile beef broth, as in the former series, were inoculated with a drop or two from these fœcal mixture tubes, then placed in the incubator and kept at 37° C., but no growth appeared in them and the fluids remained sterile. At the same time that the above experiments were made, control broth tubes were inoculated with a trace of the fœcal solution after the addition to them of the culture fluids, but before the addition of the disinfectant, these control tubes were also placed in the incubator and kept at 37° C., they all showed abundant normal growth after twenty-four hours of the choleraic bacilli and of the typhoid bacilli respectively.

(Signed) E. KLEIN, M.D., F.R.S.,
Professor of Bacteriology at the College of State Medicine, London.

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I hereby certify that I have analysed a sample of the "St. Bede Disinfectant," manufactured by Messrs. The St. Bede Chemical Company (Limited), Newcastle-upon-Tyne, and that I find it contains as follows :—

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Oxide of Iron, &c.	0·27 ,,
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